U.S. Department of the Interior
U.S. Geological Survey

Selected Ground-Water Data for Yucca Mountain Region, Southern Nevada and Eastern California, Through December 1998

Open-File Report 99-250

Prepared in cooperation with the
NEVADA OPERATIONS OFFICE of the
U.S. DEPARTMENT OF ENERGY, under
Interagency Agreement DE-AI08-92NV10874

USGS
science for a changing world

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
1999	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Selected Ground-Water Data for Yucca Mountain Region, Southern Nevada and Eastern California, Through December 1998	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **U.S. Department of the Interior 1849 C Street, NW Washington, DC 20240**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES
The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**SAR**	**93**	

U.S. Department of the Interior
U.S. Geological Survey

Selected Ground-Water Data for Yucca Mountain Region, Southern Nevada and Eastern California, Through December 1998

By Glenn L. Locke

Open-File Report 99-250

Prepared in cooperation with the
NEVADA OPERATIONS OFFICE of the
U.S. DEPARTMENT OF ENERGY, under
Interagency Agreement DE-AI08-92NV10874

Carson City, Nevada
2001

U.S. DEPARTMENT OF THE INTERIOR
GALE A. NORTON, Secretary

U.S. GEOLOGICAL SURVEY
CHARLES G. GROAT, Director

For additional information contact:

District Chief
U.S. Geological Survey
333 West Nye Lane, Room 203
Carson City, NV 89706–0866

email: GS-W-NVpublic-info@usgs.gov

http://nevada.usgs.gov

Copies of this report can be purchased from:

U.S. Geological Survey
Information Services
Building 810
Box 25286, Federal Center
Denver, CO 80225–0286

CONTENTS

FIGURES

TABLES

CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
acre-foot (acre-ft)	1,233	cubic meter
foot (ft)	0.3048	meter
gallon per minute (gal/min)	0.06309	liter per second
inch (in.)	2.54	centimeter
mile (mi)	1.609	kilometer
million gallons (Mgal)	3,785	cubic meter
pound per square inch (lb/in^2)	6.895	kilopascal

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929, formerly called "Sea-Level Datum of 1929"), which is derived from a general adjustment of the first-order leveling networks of the United States and Canada.

Selected Ground-Water Data for Yucca Mountain Region, Southern Nevada and Eastern California, Through December 1998

By Glenn L. Locke

ABSTRACT

The U.S. Geological Survey, in support of the U.S. Department of Energy, Yucca Mountain Site Characterization Project, collects, compiles, and summarizes hydrologic data in the Yucca Mountain region. The data are collected to allow assessments of ground-water resources during studies to determine the potential suitability of Yucca Mountain for storing high-level nuclear waste.

Data on ground-water levels at 34 wells and a fissure (Devils Hole), ground-water discharge at 5 springs and a flowing well, and total reported ground-water withdrawals within Crater Flat, Jackass Flats, Mercury Valley, and the Amargosa Desert are presented for calendar year 1998. Data collected prior to 1998 are graphically presented and data collected by other agencies (or as part of other Geological Survey programs) are included to further indicate variations of ground-water levels, discharges, and withdrawals through time.

A statistical summary of ground-water levels at seven wells in Jackass Flats is presented to indicate potential effects of ground-water withdrawals associated with U.S. Department of Energy activities near Yucca Mountain. The statistical summary includes the number of measurements, the maximum, minimum, and median water-level altitudes, and the average deviation of measured water-level altitudes for selected baseline periods and for calendar years 1992-98. At two water-supply wells and a nearby observation well, median water levels for calendar year 1998 were slightly lower (0.2 to 0.3 foot) than for their respective baseline periods. At the remaining four wells in Jackass Flats, median water levels for 1998 were unchanged at two wells and slightly higher (0.4 and 1.4 foot) at two wells than those for their respective baseline periods.

INTRODUCTION

Investigations are in progress or planned to determine the potential suitability of Yucca Mountain for storing high-level nuclear waste. The U.S. Department of Energy (DOE) has declared that all facilities and activities associated with such investigations will be operated in a manner that maintains or protects environmental quality, and has established programs to allow assessments of environmental quality. In April 1989, the U.S. Geological Survey (USGS) began a cooperative program with DOE to develop a ground-water-resources monitoring program in the vicinity of Yucca Mountain. The purposes of the monitoring program are to (1) document the historical and current conditions of ground-water resources, (2) detect and document changes in those resources during the investigations of Yucca Mountain, and (3) provide a basis for analyzing and identifying potential adverse effects on ground-water resources resulting from investigations of Yucca Mountain.

Purpose and Scope

This report presents and summarizes, in tabular and graphical form, data collected as part of the U.S. Geological Survey Environmental-Monitoring Program. Included are 1998 data on ground-water levels at 34 wells and a fissure (Devils Hole), ground-water discharge at 5 springs and a flowing well, and total reported ground-water withdrawals within Crater Flat, Jackass Flats, Mercury Valley, and Amargosa Desert. Data on ground-water levels, discharges, and withdrawals collected by other agencies (or collected as part of other USGS programs) at the sites are included also to further indicate variations through time at selected monitoring locations.

A discussion of ground-water data for Jackass Flats includes a statistical summary of that data to indicate potential effects of withdrawals from wells in Jackass Flats on water levels near Yucca Mountain. Effects of these withdrawals may be detected in Jackass Flats before they are detected elsewhere in the Yucca Mountain region.

This report is the seventh of a series of annual reports as part of the U.S. Geological Survey Environmental-Monitoring Program. Hereafter, these first six reports are referred to as previous reports on selected ground-water data for the Yucca Mountain region. The previous reports and the data contained are:

Report (see references cited)	Data contained
LaCamera and Westenburg (1994)	Earliest available data through 1992
Hale and Westenburg (1995)	Data collected in 1993
Westenburg and LaCamera (1996)	Data collected in 1994
LaCamera, Westenburg, and Locke (1996)	Data collected in 1995
LaCamera and Locke (1997)	Data collected in 1996
LaCamera, Locke, and Munson (1999)	Data collected in 1997

Additional information for sites CF-2, JF-1, JF-2, JF-2a, J-13, J-11, and J-12 is presented by Robison (1984), Robison and others (1988), Gemmel (1990), McKinley and others (1991), O'Brien (1991, 1993), Luckey and others (1993), Boucher (1994), Lobmeyer and others (1995), O'Brien and others (1995), Graves and others (1996), Tucci and others (1996a, 1996b), and Graves and Goemaat (1998).

Acknowledgments

Several organizations and programs contributed to this report. Specifically, data were provided by National Park Service; U.S. Fish and Wildlife Service; Nevada Department of Conservation and Natural Resources, Division of Water Resources; Nevada Department of Transportation; Barrick Bullfrog Inc.; Bechtel Nevada; Cathedral Gold U.S. Corporation; Cind-R-Lite Company; Daisy Gold Mining Company; Fenix and Scisson, Inc.; Raytheon Services Nevada; Reynolds Electrical and Engineering Company; U.S. Borax Corporation; U.S. Nevada Gold Search; USGS–Hydrologic Resources Management and Environmental Restoration Programs; and USGS–Yucca Mountain Project Branch studies of saturated-zone site hydrology and saturated-zone regional hydrology.

Additionally, the author acknowledges the cooperation of the many individual property owners throughout the Amargosa Desert who allowed access to their property and the collection of hydrologic data.

DESCRIPTION OF STUDY AREA

The study area is the Yucca Mountain region of southern Nevada and eastern California (fig. 1). The boundary of the Yucca Mountain region, for purposes of this report, roughly coincides with the northern parts of Crater Flat and Jackass Flats, eastern parts of Rock Valley, Mercury Valley, and Amargosa Desert, and Death Valley Junction and Furnace Creek, Calif., to the south and west. The region is within the Great Basin, a subdivision of the Basin and Range Physiographic Province (Fenneman, 1931, p. 328).

The study area is in the Death Valley ground-water flow system (Harrill and others, 1988, sheet 1) and, within that flow system, the Alkali Flat-Furnace Creek Ranch and Ash Meadows ground-water subbasins. Each ground-water subbasin is a zone consisting of ground-water recharge areas and flow paths to points of discharge at land surface (Waddell and others, 1984, p. 36; Laczniak and others, 1996, p. 16 and pl. 1). Boundaries of the subbasins are defined on the basis of the location of recharge areas, discharge areas, low-permeability rocks, hydraulic gradients, and water chemistry. These boundaries are general indicators of restrictions on ground-water movement in the region.

The study area is also subdivided by hydrographic areas[1] (fig. 1). As defined by Rush (1968, p. 4), hydrographic areas generally consist of valleys (topographic lows) extending to their surrounding surface-water drainage divides (topographic highs). Hydrographic areas in the study area include Crater Flat, Jackass Flats, and Rock Valley, most of Mercury Valley and Amargosa Desert, and part of Death Valley (Rush, 1968; Harrill and others, 1988, sheet 2).

[1]Formal hydrographic areas in Nevada were delineated systematically by the U.S. Geological Survey and Nevada Division of Water Resources in the late 1960's for scientific and administrative purposes (Rush, 1968; Cardinalli and others, 1968). The official hydrographic area names, numbers, and geographic boundaries continue to be used in Geological Survey scientific reports and Division of Water Resources administrative activities. Extensions of hydrographic areas from Nevada into California and selected hydrographic areas in California have been delineated also by Harrill and others (1988, sheet 2).

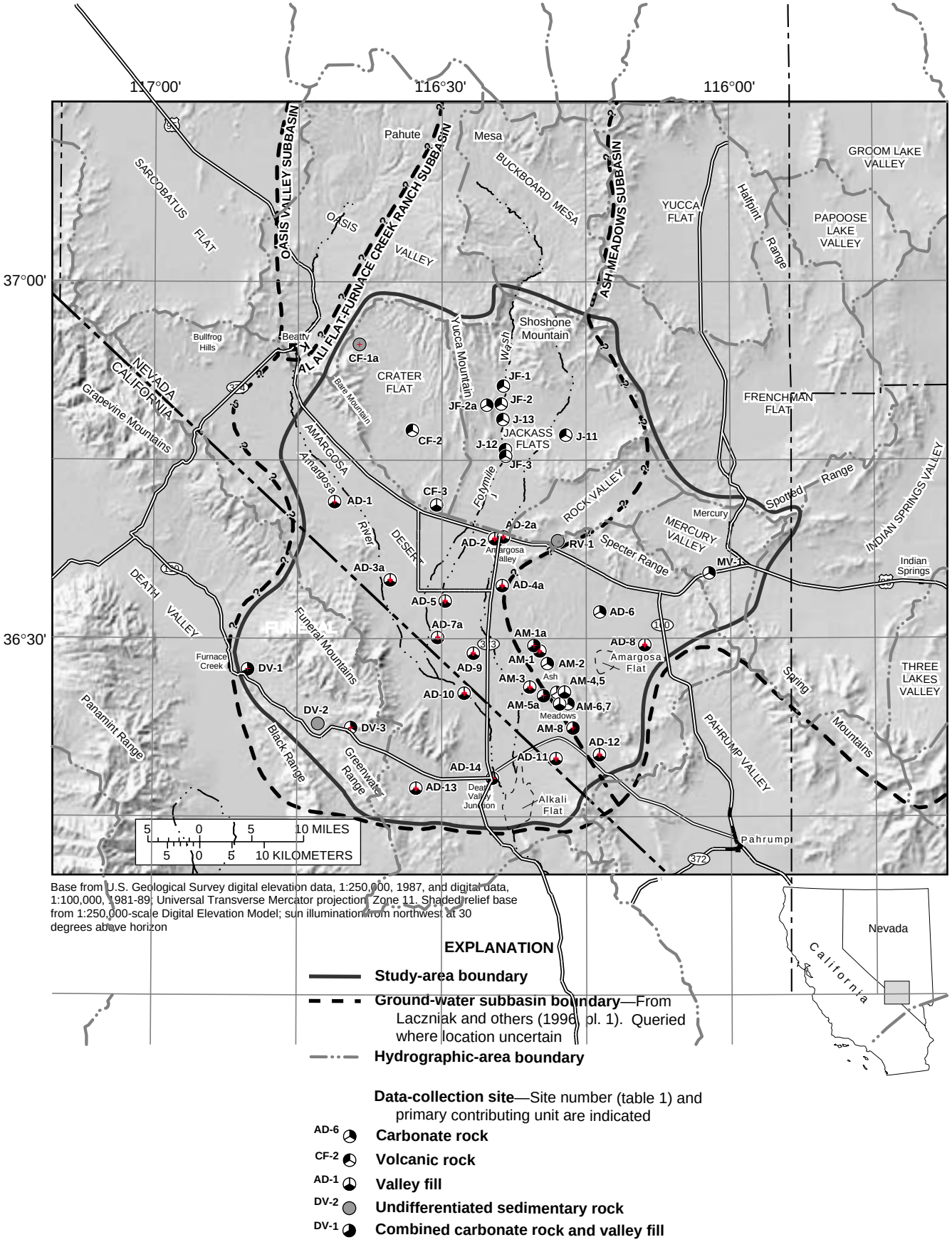

Figure 1. Location of data-collection sites for calendar year 1998, Yucca Mountain region of southern Nevada and eastern California.

Alkali Flat-Furnace Creek Ranch Ground-Water Subbasin

Crater Flat and Jackass Flats (which include Yucca Mountain), most of Rock Valley, the west-central part of the Amargosa Desert, and part of Death Valley are in the Alkali Flat-Furnace Creek Ranch ground-water subbasin (fig. 1). Within this subbasin, sources of ground water principally are precipitation and subsurface inflow (Laczniak and others, 1996, table 3; Waddell and others, 1984, p. 36; Harrill and others, 1988, sheet 2). Precipitation occurs on the higher mesas and mountains within the subbasin and along the subbasin's north and northeast mountainous boundaries. Inflow into the subbasin occurs near Beatty from the Oasis Valley subbasin, near Ash Meadows from the Ash Meadows subbasin, and from Cactus Flat. Ground water discharges principally as springflow at Death Valley and as evapotranspiration from Alkali Flat and Death Valley. Ground water generally flows to the south, southeast, or southwest and discharges principally in Death Valley and at Alkali Flat (Kilroy, 1991, p. 9–13; Laczniak and others, 1996, pl. 1; Tucci and Burkhardt, 1995, p. 8).

Ash Meadows Ground-Water Subbasin

Part of Rock Valley, most of Mercury Valley, and the eastern part of the Amargosa Desert are within the Ash Meadows subbasin (fig. 1). The southeastern part of the Amargosa Desert includes the Ash Meadows spring-discharge area. The Ash Meadows spring-discharge area is a gently sloping land watered by numerous springs (Dudley and Larson, 1976, p. 5) at the southwestern edge of the subbasin.

In the Ash Meadows ground-water subbasin, sources of ground water principally are precipitation and subsurface inflow (Laczniak and others, 1996, table 3). Precipitation occurs on the higher mountains within the subbasin and along the subbasin's north and northeast mountainous boundaries. Inflow occurs from Railroad Valley and Pahranagat Valley along the basin's north and northeast boundaries. Ground water discharges principally as springflow and evapotranspiration in the Ash Meadows area and possibly as underflow into the Alkali Flat-Furnace Creek Ranch ground-water subbasin. Ground water in the subbasin generally flows to the south, west, or southwest (Harrill and others, 1988, sheet 2; Laczniak and others, 1996, p. 16–18 and pl. 1).

DATA-COLLECTION SITES

Locations of data-collection sites are shown in figure 1. Information on site identification, site location, site owner, and the types of data contained in this report are given in table 1 for each site. Information on site identification, well construction, source of well-construction data, and contributing lithologic units are given in tables 1 and 2. All sites are wells or springs except site AM-4 (Devils Hole), which is an open fissure that intersects the ground-water table.

Site Number

Sites are identified by an alphanumeric number in this report. The site number consists of two parts. The first part represents the hydrographic area in which the site is located: "CF" represents Crater Flat; "JF" or "J," Jackass Flats; "RV," Rock Valley; "MV," Mercury Valley; "AD" or "AM," Amargosa Desert; and "DV," Death Valley. "AM" further indicates that the site is located in the Ash Meadows spring-discharge area. The second part of the number represents the relative location of the site within the hydrographic area (or Ash Meadows spring-discharge area). Within each hydrographic area, sites generally are numbered sequentially in a north-to-south, then west-to-east order. Sites added subsequent to the initial numbering also are numbered as indicated above or are assigned the number of a nearby site and given the suffix of "a." Exceptions are sites J-13, J-11, and J-12, which are or were intended water-supply wells and were previously numbered by Raytheon Services Nevada; they were not renumbered for this report. The sequence of the sites in table 1 is followed throughout the report.

U.S. Geological Survey Site Identification

Sites are identified by the U.S. Geological Survey standard identification system. The standard identification is based on the grid system of latitude and longitude. The identification consists of 15 digits. The first six denote the degrees, minutes, and seconds of latitude; the next seven digits denote degrees, minutes, and seconds of longitude; and the last two digits (assigned sequentially) identify the sites within a 1-second grid. For example, site 363530116021401 is at approximately 36°35'30" latitude and 116°02'14" longitude, and it is the first site recorded in that 1-second grid. The assigned number is retained as a permanent identifier even if a more precise latitude and longitude are later determined. Latitude and longitude shown for a site, therefore, are the most accurate locators.

Table 1. Index to monitoring sites in Yucca Mountain region for calendar year 1998

Site number: Sites are grouped by hydrographic area and, within each area, are listed in general north-to-south, then west-to-east order. See text section "Site Number" for further discussion.

U.S. Geological Survey site identification: Unique identification number for sites as stored in files and data bases of U.S. Geological Survey.

Local site number: Alphanumeric number based on location of site within hydrographic areas and rectangular subdivisions of public lands. See text section "Local Site Number" for further discussion.

Owner: Abbreviations listed for sites owned by federal agencies: BLM, Bureau of Land Management; NPS, National Park Service; DOE, U.S. Department of Energy; USFWS, U.S. Fish and Wildlife Service; USGS, U.S. Geological Survey.

Data type: Type of data included in this report. D, ground-water discharge; L, ground-water level.

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Local site number		Owner	Data type
CF-1a	365445116383901	GEXA Well 3	365442	1163841	229	S12 E48 07ADD1	Rayrock Mines, Inc.	L
CF-2	364732116330701	USW VH-1	364732	1163307	229	S13 E48 27C1	DOE	L
CF-3	364105116302601	Cind-R-Lite Well	364106	1163026	229	S14 E48 36DDD1	Cind-R-Lite Block Company	L
JF-1	365116116233801	UE-25 WT 15	365116	1162338	227A	S12 E50 33A1	DOE	L
JF-2	364945116235001	UE-25 WT 13	364943	1162351	227A	S13 E50 18B1	DOE	L
JF-2a	364938116252102	UE-25p 1 PTH	364938	1162521	227A	S13 E49 14A2	DOE	L
J-13	364828116234001	J-13 WW	364829	1162340	227A	S13 E50 19C1	DOE	L
J-11	364706116170601	J-11 WW	364706	1161706	227A	S13 E51 31B1	DOE	L
J-12	364554116232401	J-12 WW	364554	1162324	227A	S14 E50 06A2	DOE	L
JF-3	364528116232201	JF-3 Well	364528	1162322	227A	S14 E50 06D1	DOE	L
RV-1	363815116175901	TW-5	363815	1161759	226	S15 E50 24A1	DOE	L
MV-1	363530116021401	Army 1 WW	363530	1160214	225	S16 E53 05ADB1	DOE	L
AD-1	364141116351401	NA-6 Well BGMW-10	364131	1164114	230	S14 E47 32DA1	USGS	L
AD-2	363830116241401	Airport Well	363825	1162433	230	S15 E49 24ABB1	Doing, Warren	L
AD-2a	363835116234001	NDOT Well	363835	1162358	230	S15 E50 18CCDB1	NV Dept. of Transportation	L
AD-3a	363521116352501	Davidson Well	363525	1163530	230	S16 E48 05CAB1	Davidson, Robert	L
AD-4a	363428116234701	Cooks East Well	363430	1162345	230	S16 E50 07CABB1	Cook, Lewis C.	L
AD-5	363310116294001	USBLM Well	363325	1162945	230	S16 E49 18DCCA1	BLM	L
AD-6	363213116133800	Tracer Well 3	363213	1161338	230	S16 E51 27BAA3	USGS	L
AD-7a	363009116302702	Blackman Well	363010	1163030	230	S17 E48 01AB3	Naxos Mining Company	L
AD-8	362929116085701	Cherry Patch Well	362930	1160855	230	S17 E52 08CDB1	Clark, Hershel and others	L
AD-9	362848116264201	Gilgans North Well	362850	1162645	230	S17 E49 15BBBB1	Steelman, James C.	L
AD-10	362525116274301	NA-9 Well	362530	1162740	230	026N005E05E001S	USGS	L
AD-11	361954116181201	GS-3 Well	361957	1161752	230	S19 E50 01BBD1	USGS	L
AD-12	362014116133901	GS-1 Well	362021	1161330	230	S18 E51 34CBD1	USGS	L
AD-13	361724116324201	S-1 Well	361720	1163240	230	025N004E21M001S	USGS	L
AD-14	361817116244701	Death Valley Jct Well	361816	1162447	230	025N005E14M001S	Ettie, Lee	L
AM-1	362858116195301	Rogers Spring Well	362855	1161950	230	S17 E50 10CDD1	USFWS	L
AM-1a	362924116203001	Fairbanks Spring	362926	1162028	230	S17 E50 09AD1	USFWS	D
AM-2	362755116190401	Five Springs Well	362755	1161905	230	S17 E50 23BBCA1	USFWS	D,L
AM-3	362555116205301	Garners Well	362555	1162055	230	S17 E50 33CAAB1	Garner, George	L
AM-4	362532116172700	Devils Hole	362532	1161727	230	S17 E50 36DC1	NPS	L
AM-5	362529116171100	Devils Hole Well	362530	1161715	230	S17 E50 36DDC1	USFWS	L
AM-5a	362502116192301	Crystal Pool	362515	1161925	230	S18 E50 03ADBA1	USFWS	D
AM-6	362432116165701	Point of Rocks North Well	362430	1161655	230	S18 E51 07BBBB1	USFWS	L
AM-7	362417116163600	Point of Rocks South Well	362420	1161640	230	S18 E51 07BDB1	USFWS	L
AM-8	362230116162001	Big Spring	362229	1161625	230	S18 E51 19ACB1	USFWS	D
DV-1	362728116501101	Texas Spring	362728	1165011	243	027N001E23BS01S	NPS	D
DV-2	362252116425301	Navel Spring	362252	1164253	243	026N002E13FS01S	U.S. Borax & Chem. Corp.	D
DV-3	362230116392901	Travertine Point 1 Well	362231	1163932	243	026N003E21L001S	U.S. Borax & Chem. Corp.	L

Table 2. Well-completion data at monitoring sites in Yucca Mountain region

Site number: Sites are grouped by hydrographic area and, within each area, are listed in general north-to-south, then west-to-east order. See text section "Site Number" for further discussion.

U.S. Geological Survey site identification: Unique identification number for site as stored in files and data bases of U.S. Geological Survey (USGS).

Accessible well depth: Well depths listed are as reported in sources listed in explanation for **Data source** (see below) or as measured by USGS personnel (noted with 's'). See text section "Accessible Well Depth" for further discussion.

Casing diameter at land surface: Outside casing diameter of segment most prominent at land surface; rounded to nearest inch.

Top of open interval: Depth to top part(s) of well that can receive ground water from lithologic interval. Uncased borehole is designated open interval in this table. Open interval may be deeper than accessible well depth, which may reflect original drilled depth. As reported in sources listed in explanation for **Data source** (see below). U, unknown, no data.

Bottom of open interval: Depth to bottom part(s) of well that can receive ground water from lithologic interval. Uncased borehole is designated open interval in this table. Open interval may be deeper than accessible well depth, which may reflect original drilled depth. As reported in sources listed in explanation for **Data source** (see below). U, unknown, no data.

Diameter of open interval: Inside casing diameter; rounded to nearest inch. Hole diameter is listed where no casing is present. U, unknown, no data.

Type of open interval: Description of open interval. P, perforated or slotted casing; S, screened casing, type not known; U, unknown, no data; X, uncased borehole.

Data source: D, Well driller's log, well-completion report, or Fenix & Scisson, Inc., or Raytheon Services Nevada hole-history data; J, Johnston (1968); M, no source, data not available; O, Owner of well; R, Robison and others (1988); T, Thordarson and others (1967).

Contributing units: Saturated lithologic interval yielding water to well. C, carbonate rock; F, valley fill; S, undifferentiated sedimentary rock; V, volcanic rock. See text section "Contributing Lithologic Units" for further discussion.

Table

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Accessible well depth (feet below land surface)	Casing diameter at land surface (inches)	Open interval				Data source	Contributing units
					Feet below land surface		Diameter (inches)	Type		
					Top	Bottom				
CF-1a	365445116383901	GEXA Well 3	700	7	208	313	6	P	D	S
					513	618	6	P		
					658	700	6	P		
CF-2	364732116330701	USW VH-1	2,501	10	911	912	9	X	R	V
					912	2,501	6	X		
CF-3	364105116302601	Cind-R-Lite Well	460	9	320	460	8	P	D	F
JF-1	365116116233801	UE-25 WT 15	1,360	11	127	130	15	X	D	V
					130	1,360	9	X		
JF-2	364945116235001	UE-25 WT 13	1,160	11	222	224	15	X	D	V
					224	1,150	9	X		
					1,150	1,160	8	X		
JF-2a	364938116252102	UE-25p 1 PTH	5,923	24	4,256	4,279	10	X	R	C
					4,279	5,900	7	X		
					5,900	5,923	6	X		

Table 2. Well-completion data at monitoring sites in Yucca Mountain region—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Accessible well depth (feet below land surface)	Casing diameter at land surface (inches)	Open interval				Data source	Contributing units
					Feet below land surface		Diameter (inches)	Type		
					Top	Bottom				
J-13	364828116234001	J -13 WW	3,488	13	996	1,301	13	P	T	V
					1,301	1,386	11	P		
					2,690	3,312	5	P		
					3,385	3,488	8	X		
J-11	364706116170601	J -11 WW	1,327	13	1,075	1,095	12	P	D	V
					1,242	1,298	12	P		
J-12	364554116232401	J -12 WW	1,139	13	793	868	12	P	D	V
					887	1,139	12	X		
JF-3	364528116232201	JF- 3 Well	1,138	9	735	1,138	8	P	D	V
RV-1	363815116175901	TW- 5	800 s	7	735	800	6	P	T	S
					800	916	U	X		
MV-1	363530116021401	Army 1 WW	1,953	11	800	1,050	11	P	D	C
					1,368	1,370	10	X		
					1,370	1,684	9	X		
					1,684	1,953	7	X		
AD-1	364141116351401	NA-6 Well BGMW-10	960	2	930	940	2	S	D	F
AD-2	363830116241401	Airport Well	750 s	14	360	777	14	P	D	F
AD-2a	363835116234001	NDOT Well	495	9	395	495	8	P	D	F
AD-3a	363521116352501	Davidson Well	240 s	16	120	250	15	P	D	F
AD-4a	363428116234701	Cooks East Well	269 s	13	147	213	12	P	D	F
					238	286	12	P		
AD-5	363310116294001	USBLM Well	348 s	12	U	U	U	U	M	F
AD-6	363213116133800	Tracer Well 3	678 s	9	620	807	6	X	J	C
AD-7a	363009116302702	Blackman Well	210	7	U	U	U	U	O	F

Table 2. Well-completion data at monitoring sites in Yucca Mountain region—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Accessible well depth (feet below land surface)	Casing diameter at land surface (inches)	Open interval				Data source	Contributing units
					Feet below land surface		Diameter (inches)	Type		
					Top	Bottom				
AD-8	362929116085701	Cherry Patch Well	215 s	15	U	U	U	U	M	F
AD-9	362848116264201	Gilgans North Well	396 s	13	60	90	12	P	D	F
					154	244	12	P		
					245	396	15	X		
AD-10	362525116274301	NA-9 Well	1,090	2	1,063	1,066	2	S	D	F
AD-11	361954116181201	GS-3 Well	2,000	2	1,969	1,979	2	S	D	F
AD-12	362014116133901	GS-1 Well	1,580	2	1,549	1,559	2	S	D	F
AD-13	361724116324201	S-1 Well	2,000	2	1,969	1,979	2	S	D	F
AD-14	361817116244701	Death Valley Jct Well	225 s	12	160	200	12	S	D	F
AM-1	362858116195301	Rogers Spring Well	202 s	16	100	240	12	P	D	F
					240	420	16	X		
AM-2	362755116190401	Five Springs Well	123 s	14	0	100	13	P	D	C
					100	140	14	X		
AM-3	362555116205301	Garners Well	202 s	9	140	180	8	P	O	F
AM-5	362529116171100	Devils Hole Well	200 s	16	48	248	16	P	D	F
AM-6	362432116165701	Point of Rocks North Well	500	16	139	500	16	P	D	F
AM-7	362417116163600	Point of Rocks South Well	586 s	14	132	467	14	P	D	C
					468	818	U	X		
DV-3	362230116392901	Travertine Point 1 Well	650 s	5	100	970	5	X	D	C

Local Site Number

The local site number (table 1) is based on an index of hydrographic areas (Rush, 1968; Harrill and others, 1988) and on the rectangular subdivision of the public lands referenced to the Mount Diablo base line and meridian for sites in Nevada or San Bernadino base line and meridian for sites in California. Numbering conventions differ depending on whether a site is located in Nevada or California.

For sites in Nevada, each local number consists of four units separated by spaces: The first unit is the hydrographic area number. The second unit is the township, preceded by an N or S to indicate location north or south of the base line. The third unit is the range, preceded by an E to indicate location east of the meridian. The fourth unit consists of the section number and letters designating the quarter section, quarter-quarter section and so on (A, B, C, and D, indicate the northeast, northwest, southwest, and southeast quarters, respectively), followed by a number indicating the sequence in which the well was recorded. For example, site 230 S18 E51 34CBD1 is in the Amargosa Desert (hydrographic area 230) and is the first site recorded in the southeast quarter of the northwest quarter of the southwest quarter of section 34, township 18 south, range 51 east, Mount Diablo base line and meridian.

For sites in California, the local number consists of the hydrographic area number followed by three spaces. The next 10 characters indicate the township and location north or south of the baseline, the range and location east or west of the meridian, and the section number. The letter following the section number designates the 40-acre subdivision of the section in which the site is located (U.S. Geological Survey, 1996). The final letter indicates that the location is referenced to the San Bernardino (S) base line and meridian and is preceded by a 3-digit number (for wells) or an "S" and 2-digit number (for springs) indicating the sequence in which the site was recorded. For example, site 230 025N005E14M001S is a well in the Amargosa Desert (hydrographic area 230) and is the first site recorded in the 40-acre subdivision designated M of section 14, township 25 north, range 5 east, San Bernardino base line and meridian.

Data Type

Data type (table 1) identifies the types of data (water level and discharge) presented for each site. Ground-water-level data are in tables 5–7 and ground-water-discharge data are in table 8.

Accessible Well Depth

Accessible well depth (table 2) is the measurable depth to the bottom of the well. The drilled depth may be greater than the accessible depth of the well due to modifications of the well, obstructions, or accumulation of sediment at the bottom of the well. The depth of each well was measured by USGS (depths noted with "s") or was reported by other data sources. The USGS measured depths less than 1,000 ft by "sounding" the bottom of the well with weighted steel or electric tapes.

Top and Bottom of Open Interval

Open intervals (table 2) are parts of the well that are open to the surrounding lithologic intervals and may allow water to enter the well. An uncased section of a well is considered an open interval in this report.

Type of Open Interval

Type of open interval (table 2) is a physical description of the open intervals of a borehole. The types of openings are perforated or slotted casing, screened casing, and open hole with no casing.

Data Source

Data sources (table 2) are organizations or publications from which information on depth of the well, open interval, and type of opening was obtained. Drillers' logs or records are filed with the Nevada Division of Water Resources (NDWR) or maintained by the well owner; Fenix and Scisson, Inc., and Raytheon Services Nevada were contractors for DOE and maintained a summary of well-construction information for selected wells in the area. Publications are USGS reports written for DOE as part of cooperative studies associated with weapons-testing hydrology programs (Thordarson and others, 1967; Johnston, 1968) or Yucca Mountain site-characterization studies (Robison and others, 1988).

Contributing Lithologic Units

Contributing units (table 2) are the principal lithologic intervals at the site that yield water to the well. For purposes of this report, contributing units are one or a combination of four general types. Wells characterized as having a contributing unit of carbonate or volcanic rock are wells with open intervals in those consolidated rocks. In and near the Amargosa Desert, wells characterized as having a contributing unit of valley fill are those with open intervals in unconsolidated valley-filling materials, including lakebed deposits. Wells with open intervals in clastic rock (including argillite, limy sandstones and siltstones, or silty, sandy, and shaley limestones) are characterized as having a contributing unit of undifferentiated sedimentary rock.

Robison and others (1988) describe the contributing units at sites CF-2, JF-1, JF-2, JF-2a, and J-13. McKinley and others (1991) describe the contributing units for sites J-11, J-12, MV-1, AD-4a, AD-5, AD-6, AD-8, and AM-4. Thordarson and others (1967) describe the contributing unit at site RV-1. Dudley and Larson (1976) describe the contributing units for sites AM-2, AM-5, and AM-7. Contributing-unit data are not available from listed data sources for some wells; the contributing units indicated for those wells are derived from drillers' logs or well-completion reports that describe geology in the boreholes, open intervals in the wells, and measurements of depth to water.

Contributing units for springs (fig. 1) indicate sources of water discharged at the sites. Winograd and Thordarson (1975, p. C75-C97) describe sources of discharge at sites AM-1a, AM-5a, AM-8, and DV-1. McKinley and others (1991) describe the source of discharge at site DV-2.

DATA-COLLECTION PROCEDURES AND EQUIPMENT

Water-level and discharge data for monitoring sites were compiled from available sources, from USGS files and data bases, and from measurements made by U.S. Geological Survey Environmental-Monitoring Program (USGS-EMP) personnel. Data-collection procedures and equipment used by USGS-EMP are described in detail, and equipment used by other sources are described briefly. Water-use data are compiled from available sources as described in the section "Ground-Water Withdrawal Data."

Periodic Water-Level Data

Periodic water-level measurements in table 5 are generally made during site visits, using one of the methods described in the section "Water-Level Measurements." An exception is data that are based on water levels continually collected by the National Park Service (NPS) at site AM-4 (Devils Hole; see section "Other"). Supplemental information, including land-surface altitude, height of measurement point, method of measurement, site status, and source of data, is also listed in table 5.

Land-Surface Altitude and Height of Measurement Point

Land-surface altitude and height of the measurement point (MP) above (or depth below) land surface are included with periodically collected data in table 5. Land-surface altitude is a representative altitude of land at or near the site. An exception is site AM-4, where the land-surface altitude represents the altitude of the measurement point (a bolt fastened to the south wall of the fissure) that is not referenced to land surface. Land surveys were made by USGS personnel at the monitoring sites to determine the altitudes of land surface or the MP.

Heights of MP's for sites in Amargosa Desert (except AM-4), Death Valley, and Rock Valley were determined by measuring the distance of the MP above (or depth below) a representative point on the land surface at or near the well. The altitude of the MP was determined during the USGS land survey, and land-surface altitude was computed by adding or subtracting the MP height from the surveyed MP altitude.

At sites JF-1, JF-2, JF-2a, and J-13, USGS land surveys verified previously reported land-surface and MP altitudes. At sites CF-2, J-11, and J-12, USGS land surveys verified the previously reported land-surface altitudes and determined the MP altitude by adding the height of the MP to the land-surface altitude. At sites CF-1a, and MV-1, USGS land surveys determined the land surface and MP altitudes; the height of the MP is the difference between the MP altitude and land-surface altitude. Land-surface altitudes are reported to the nearest tenth of a foot.

Depth to Water and Altitude of Water Surface

Depth to water in feet below land surface is computed as the measured depth to water below the MP minus the height of the MP from land surface at the well. At site AM-4, the depth to water is measured below the MP, but the MP is not referenced to land surface. The altitude of water surface is the depth to water subtracted from the altitude of land surface and is reported to the nearest tenth of a foot.

Water-Level Measurements

Periodic water-level measurements made by USGS-EMP personnel were made using the procedures and equipment described in the following sections. Measurement methods by other sources are also briefly described.

Calibrated Electric Tape

USGS-EMP personnel used two calibrated 1,000-ft electric tapes and one calibrated 2,000-ft electric tape during 1998. Each tape was marked with a unique identifier (YMP-7, YMP-13 and PRT-3) for quality-assurance purposes. The electric tapes were calibrated against steel tapes. At depths less than 500 ft, the electric tapes were calibrated against a steel tape maintained by USGS-EMP personnel and identified as the 500-ft reference steel tape #1. At depths greater than 500 ft, the electric tapes were calibrated against the U.S. Geological Survey Site-Characterization Project (USGS-SCP) 2,600-ft calibrated steel tape identified by USGS-SCP as Chain #3. In February 1998, the electric tapes were calibrated against the Nevada Test Site (NTS) USGS/DOE Cooperative Program 2,000-ft reference steel tape at one site. Selected calibration data for the electric tapes are summarized in table 3. Calibration data for tapes YMP-7 and PRT-2 presented in La Camera and others (1999, table 3) are not repeated in this report.

The corrections to the USGS-SCP calibrated steel tape account for mechanical stretch and thermal expansion of the tape. No corrections were necessary to the NTS USGS/DOE Cooperative Program reference steel tape (D.J. Bright, U.S. Geological Survey, oral commun., 1998). No corrections were necessary for the USGS-EMP 500-ft reference steel tape #1 because mechanical stretch and thermal expansion of the tape are considered negligible at the depths to water measured. The correction for the electric tapes is the difference between the corrected steel-tape measurement and the uncorrected electric-tape measurement.

A summary of correction factors applied to USGS-EMP electric tapes for 1998 is listed in table 4. Correction factors applied to electric-tape measurements ranged from +0.03 to -0.57 ft. -The correction factor is used to adjust depth-to-water measurements made with an electric tape to account for mechanical stretch, incorrect markings, and changes to the physical condition of the tape. The measurement period represents the time during which the correction factors were applied. Applied correction factors for 1998 usually are averages of individual correction factors; individual correction factors include discrete corrections presented in table 3 of this report and applied factors listed in table 4 of the previous report on selected groundwater data for the Yucca Mountain Region.

Applied correction factors for specific depth ranges are based on measurement periods in which differences of 0.05 ft or less are calculated between (1) the average of individual correction factors within a particular range of depths to water and (2) the individual correction factors within that range. For example, the -0.12 ft for applied correction factor for tape YMP-13 (in the depth range 500–699 ft) is an average of the individual correction factors -0.10 ft and -0.15 ft determined on July 8, 1998, and January 20, 1999. When an applied correction factor for a depth range cannot be derived accordingly, presumably due to an indeterminate change in the physical condition of a tape, the applied correction factor for a measurement period is calculated from a linear proration of factors determined for successive calibrations. Linear prorations of correction factors are applied by time and are represented by listing the beginning and ending factors separated by "to" in table 4.

Applied correction factors also may be based on measurement periods in which differences of 0.05 ft or less are calculated between (1) an average of factors for specific depth ranges (as derived above) and (2) all individual correction factors within those ranges. For example, the -0.03 ft applied correction factor for tape YMP-13 (in the 100–299 ft and 300–499 ft depth ranges in table 4) is an average of the -0.01 ft and -0.04 ft factors determined for each depth range and is within 0.05 ft of the individual correction factors 0.00, -0.01, 0.00, -0.06, -0.03, and -0.06 (table 3).

Table 3. Electric-tape calibration data used to derive correction factors for calendar year 1998. Calibration data used to derive correction factors but not listed herein are presented in the previous report on selected ground-water data for Yucca Mountain region.

[USGS-EMP ST1, U.S. Geological Survey Environmental-Monitoring Program 500-ft reference steel tape #1; USGS-SCP ST3, U.S. Geological Survey Site-Characterization Project Chain #3 (steel tape); USGS/DOE ST, NTS U.S. Geological Survey/Department of Energy Cooperative Program 2,000-ft reference steel tape]

Date	Site number (fig. 1)	Tape used	Depth below measuring point		Correction (feet)
			Uncorrected (feet)	Corrected (feet)	
01-21-98	AD-5	USGS-EMP ST1	126.90	126.90	0.00
		YMP-13	126.90	126.90	.00
	AD-13	USGS-EMP ST1	382.34	382.34	.00
		YMP-13	382.35	382.34	-.01
02-25-98	CF-2	USGS/DOE ST	605.28	605.28	.00
		YMP-13	605.25	605.28	+.03
07-08-98	AD-5	USGS-EMP ST1	128.16	128.16	.00
		YMP-13	128.16	128.16	.00
	AD-13	USGS-EMP ST1	381.78	381.78	.00
		YMP-13	381.84	381.78	-.06
	CF-2	USGS-SCP ST3	605.00	605.00	.00
		YMP-13	605.10	605.00	-.10
		PRT-3	605.22	605.00	-.22
07-09-98	J-12	USGS-SCP ST3	744.22	744.22	.00
		YMP-13	744.29	744.22	-.07
		PRT-3	744.42	744.22	-.20
	JF-2	USGS-SCP ST3	996.48	996.48	.00
		PRT-3	996.95	996.48	-.47
	JF-1	USGS-SCP ST3	1162.11	1162.11	.00
		PRT-3	1162.54	1162.11	-.43
01-20-99	AD-5	USGS-EMP ST1	128.83	128.83	.00
		YMP-13	128.86	128.83	-.03
	AD-13	USGS-EMP ST1	375.63	375.63	.00
		YMP-13	375.69	375.63	-.06
	CF-2	USGS-SCP ST3	604.92	604.92	.00
		YMP-13	605.07	604.92	-.15
		PRT-3	605.21	604.92	-.29
01-21-99	J-12	USGS-SCP ST3	744.16	744.16	.00
		YMP-13	744.32	744.16	-.16
		PRT-3	744.52	744.16	-.36
	JF-1	USGS-SCP ST3	1162.94	1161.94	.00
		PRT-3	1162.48	1161.94	-.54
01-25-99	JF-2	USGS-SCP ST3	996.08	996.08	.00
		PRT-3	996.65	996.08	-.57

Table 4. Applied correction factors for electric tapes used during calendar year 1998. Correction factors for 1998 are based on calibration data listed in table 3 of this report and data listed in table 4 of the previous report on selected ground-water data for Yucca Mountain Region.

[--, no measurements made for given depth-to-water range during period specified]

Tape	Measurement period		Correction factors for indicated depth ranges (feet)					
	Start	End	100-299	300-499	500-699	700-899	900-1,099	1,100-1,299
PRT-3	02-26-98	07-09-98	--	--	-0.09 to -0.26	-0.18	-0.46	-0.28 to -0.43
PRT-3	07-10-98	01-25-99	--	--	-.26	-.18 to -.36	-.46 to -.57	-.43 to -.54
YMP-7	07-15-97	02-25-98	-0.06	-0.26	-.36	-.44	--	--
YMP-13	02-25-98	07-09-98	-.03	-.03	+.03 to -.12	-.04	--	--
YMP-13	07-10-98	01-21-99	-.03	-.03	-.12	-.04 to -.16	--	--

Calibrated electric tapes were used at wells when frequent repetitive measurements were required due to fluctuating water levels, depths to water were greater than 500 ft, or wet conditions inside a well prevented measurements using chalked steel tapes. Electric-tape measurements are made by lowering the end of the tape to the water surface until a signal is activated when a probe on the end of the tape contacts the water. The tape is raised and lowered slowly until the exact point of contact is located. While holding the tape on the MP, the depth to water below the MP is read from markings on the tape. At least two measurements are made during each site visit, and supplemental measurements are made if those two measured depths differ by more than 0.05 ft. If supplemental measurements indicate the difference is due to rapidly changing water levels, the measured depths and appropriate site status are recorded. Measurements using calibrated electric tapes are indicated by method “V” in table 5.

An example calculation of depth to water below land surface for a site, using USGS-EMP calibrated electric tape PRT-3, is shown below:

Location: JF-3
Date: June 26, 1998 Time: 1601
Tape ID: PRT-3 Correction factor: -0.18 ft
(for depths from 700 to 899 ft)

Depth below MP	712.77 ft
Correction factor	-.18 ft
Corrected depth below MP	712.59 ft
Height of MP above land surface	-2.27 ft
Depth to water below land surface	710.32 ft

Water-level measurements were made with electric tapes by the U.S. Fish and Wildlife Service (USFWS) at sites AM-1, AM-5, AM-6, and AM-7 and by the Nevada Division of Water Resources (NDWR) at sites AD-7a and AD-9. Barrick Bullfrog, Inc., made electric-tape measurements at site AD-1. All these measurements are listed with method "T" in table 5.

Steel Tape

In 1998, USGS-EMP personnel maintained one 500-ft steel tape as a reference tape and used two field steel tapes (one 500-ft and one 300-ft tapes) for routine measurements. The steel tapes are uniquely marked (reference steel tape #1, ST-5, and ST-6). The steel tapes were checked against the reference tape at several depths to water to verify their accuracy. No corrections to the measurements made with these steel tapes were needed in 1998.

General procedures for using 300- and 500-ft steel tapes are to (1) chalk the bottom section of the tape, (2) lower the tape into the well until part of the chalked section is below the water surface, (3) hold the tape on the MP and record the “hold” reading, (4) raise the end of the tape to the surface, observing the “cut” (the top of the wet part of the chalked tape), (5) record the reading of the cut, (6) calculate the depth to water below the MP by subtracting the “cut” reading from the “hold” reading, and (7) calculate the depth to water below land surface by subtracting the height of the MP from the depth to water below MP. USGS-EMP personnel make a minimum of two measurements during

each site visit to verify the initial measurement. Supplemental measurements are made if the two measured depths differ by more than 0.05 ft. If supplemental measurements indicate the difference is due to fluctuating water levels, the measured depths and appropriate site status are recorded.

USGS-SCP personnel made water-level measurements using calibrated steel tapes at sites CF-2, JF-1, JF-2, JF-2a, J-13, J-11, and J-12. Descriptions of the steel tapes, applicable corrections, and procedures used by USGS-SCP for making steel-tape measurements are given by Robison and others (1988, p. 6–11), Gemmell (1990, p. 8–12), O'Brien (1991, p. 8–13), O'Brien and others (1995, p. 4–7), Graves and others, (1996, p. 5–10), Tucci and others (1996a, p. 5–8; 1996b, p. 5–8), and Graves and Goemaat (1998, p. 5–11). USGS-SCP steel-tape measurements were compiled from information provided by USGS-SCP (R.P. Graves, U.S. Geological Survey, written communs., 1998 and 1999). Corrected depth-below-MP measurements were provided by USGS-SCP personnel and converted to depth below land surface by USGS-EMP personnel by subtracting the height of the MP above land surface.

Water-level measurements were made with steel tapes by personnel from the NDWR at site AD-9 and by other programs of the USGS Nevada District at sites AM-5 and AM-7. Measurements also were made with steel tape by the NTS USGS/DOE Cooperative Program at sites CF-2 and J-12. All measurements using steel tapes are listed with method "S" in table 5.

Other

Site AM-4 (Devils Hole) has a small metal bolt fastened to the south wall of the fissure; the bolt is the measurement point and depth-to-water below the MP is measured with a ruled tape by USGS-EMP personnel during site visits. Such measurements are listed with method “N” in table 5. A continual recorder, operated by the NPS at site AM-4, also records water level based on depth to water below the measurement point. The daily mean water levels reported by the NPS are used to compute monthly average water levels; those monthly average water levels, indicated with method “A” in table 5, are listed as periodic water-level data for the 15th of the month.

USGS-SCP personnel made two water-level measurements using a calibrated wireline device at site J-11. The measurements were compiled from information provided by USGS-SCP (R.P. Graves, U.S. Geological Survey, written commun., 1998). Corrected depth-below-MP measurements were provided by USGS-SCP personnel and converted to depth below land surface by USGS-EMP personnel by subtracting the height of the MP above land surface. The measurements using the wireline device is listed in table 5 as method “W.”

Continual Water-Level Data

Two sites, JF-3 and AD-6, are instrumented by USGS-EMP to continually record ground-water level, atmospheric pressure, and battery voltage at 15-minute intervals. Instrumentation includes a gaged (vented) pressure sensor installed below the water surface, a barometer, and a data logger. Recorded data are processed to produce data on continual depth to water, atmospheric pressure, battery voltage, and daily average depth to water.

The pressure sensors at sites JF-3 and AD-6 transmit data to the data logger in pounds per square inch, which varies with the height of the water above the sensor. The range of output is 0 to 5.000 lb/in^2, which corresponds to a theoretical range of 0 to 11.53 ft of water above the pressure sensor. The general steps for installing and calibrating pressure sensors and processing pressure-sensor data are as follows:

1. Depth to water below MP is measured with a calibrated steel or electric tape and recorded on a field sheet. If a calibrated electric-tape measurement is made, a correction factor is applied. Depth to water below MP is used for pressure-sensor calibration, rather than depth to water below land surface, because a fixed point of reference is required.
2. The pressure-sensor cable is connected to a data logger and the sensor is lowered down the well until a substantial change in readings indicates the water surface has been reached.
3. The sensor is lowered to a set point and the pressure-sensor readings are recorded after the sensor equilibrates. The set-point depth of the sensor is determined by adding the depth-to-water measurement to the depth at which the sensor is installed below the water surface. For example, if the depth-to-water is 710 ft below the MP and the sensor is installed 5 ft below the water surface, the set-point depth is 715 ft. The sensor cable is marked or tagged at the MP. This mark or tag is used for making measurements when the pressure sensor is raised or lowered.

4. Following installation, the sensor is calibrated for a range of depths that spans the anticipated range of water-level fluctuation. Water-level fluctuations (differing depths to water below the MP) are simulated by raising and lowering the pressure sensor. Raising the sensor 1 ft above the set point will decrease the amount of submergence of the pressure sensor by 1 ft, thereby simulating a 1 ft increase in depth to water. For example, if the depth to water is 710 ft below the MP (step 1) and the sensor is raised 1 ft, the simulated depth to water below the MP would be 711 ft (710+1=711 ft). Lowering the sensor 1 ft below the set point will increase the amount of submergence of the pressure sensor by 1 ft, thereby simulating a 1 ft decrease in depth to water. If the depth to water is 710 ft below the MP and the sensor is lowered 1 ft, the simulated depth to water below the MP would be 709 ft (710-1=709 ft).

   The sensor is raised and lowered at 1/2-, 1-, or 2-ft intervals above or below the set point. The tag or marking placed on the sensor cable at the set point (step 3) provides a reference for measuring the distance the sensor is raised or lowered. After the sensor output has stabilized at each interval, the time, pressure readings from the data logger (in pounds per square inch), distance of sensor above or below the set point, and simulated depth to water are recorded on the field sheet. The sensor cable is marked or tagged at the measured intervals and later used for calibration checks.

5. Upon completion of pressure-sensor calibration, the sensor is returned to the set point and the time and pressure readings from the data logger are recorded on the field sheet. Another water-level measurement is made with a calibrated steel or electric tape and recorded to check for fluctuation of the water level during installation or calibration of the sensor.

6. Data recorded while calibrating the sensor are used to develop a regression equation to convert pressure readings to water level below MP. The pressure readings from the data logger and corresponding simulated depths below the MP are regressed using pressure (in pounds per square inch) as the independent variable and depth below the MP (in feet) as the dependent variable.

The applicable period for utilizing a particular regression equation (to convert pressure readings to depth to water below the MP) generally corresponds with calibrations at the beginning and ending of that period. In some cases, however, the applicable period for a regression equation does not correspond with successive calibrations; a period is selected that minimizes differences between reference measurements made during site visits and computed water levels at dates intermediate to the two calibrations.

Water-level measurements are made with a calibrated steel or electric tape when a continual monitoring site is visited. The pressure-sensor reading is recorded by the data logger at the time of the measurement. The reading is converted to depth to water, using the established regression equation, and recorded on a field sheet as computed water level. The steel tape or electric tape water-level measurement is used as a reference measurement and is compared to the computed value. Any difference between the reference measurement and computed value is applied as a correction to the continual record by linearly prorating the difference with time between consecutive visits to account for drift in pressure-sensor output.

Data are retrieved from the data logger using a portable computer, transferred to the USGS National Water-Information System (NWIS), and processed using data-base programs. The pressure-sensor data are converted to depths below land surface and stored. Daily average values are computed from the continual data and stored in the data base. Daily average depth-to-water values are used to compute daily average water-level altitudes, which also are stored in the data base.

Pressure-Sensor System at Site JF-3

Instrumentation has been installed at JF-3 since May 28, 1992, to continually collect water-level data every 15 minutes. The pressure sensor used to collected data in 1998 was first installed on February 4, 1997, and was recalibrated on January 23, 1998. A new regression equation was developed: depth to water below land surface (ft) = (-2.324 × pressure reading) + 714.276 (ft). The coefficient of determination of the regression equation was 1.0. Pressure readings stored in the data base from January 1 to September 17, 1998, were converted to depth below land surface with this equation to minimize differences between reference measurements and computed water levels. Differences between reference measurements made with calibrated

electric tapes and computed water levels, based on conversion of pressure readings during that period, ranged from 0.00 ft (July 23) to -0.07 ft (February 26).

On February 3, 1999, the sensor was recalibrated and a new regression equation was developed: depth to water below land surface (ft) = (-2.346 × pressure reading) + 714.228 (ft). The coefficient of determination of the regression equation was 1.0. This equation was used from September 17 to December 31, 1998, thereby minimizing corrections to computed water levels. Differences between reference measurements made with calibrated electric tapes and computed water levels ranged from 0.01 ft (September 17) to -0.06 ft (December 22).

Depth-to-water measurements made with calibrated electric tapes during 1998 (table 5) ranged from 710.07 ft (October 29) to 710.47 ft (August 27) below land surface. The daily average water levels during 1998 (table 6) ranged from 709.70 ft (December 19) to 710.65 ft (March 9) below land surface.

Pressure-Sensor System at Site AD-6

Instrumentation has been installed at AD-6 since July 29, 1992, to continually collect water-level data every 15 minutes. The pressure sensor used to collect data in 1998 was first installed on February 6, 1997, and was recalibrated on January 12, 1998. A new regression equation was developed: depth to water below land surface (ft) = (-2.330 × pressure reading) + 46.721 (ft). The coefficient of determination of the regression equation was 1.0. Pressure readings stored in the data base from January 1 to October 30, 1998, were converted to depth below land surface with this equation to minimize differences between reference measurements and computed water levels. Differences between reference measurements made with steel tapes and computed water levels, based on the conversion of pressure readings during that period, ranged from 0.00 ft (January 12, March 19, June 18, July 23, and September 17, 1998) to -0.02 ft (April 11, 1998).

On February 3, 1999, the pressure sensor was recalibrated and a new regression equation was developed: depth to water below land surface (ft) = (-2.332 × pressure reading) + 46.722 (ft). The coefficient of determination of the regression equation was 1.0. This equation was used from October 30 to December 31, 1998, thereby minimizing corrections to computed water levels. Differences between reference measurements made with steel tapes and computed water levels ranged from 0.00 ft (November 24, 1998) to -0.02 ft (October 30, 1998).

Depth-to-water measurements made with steel tapes during 1998 (table 5) ranged from 41.54 ft (December 18) to 41.73 ft (April 16, June 18, and July 23, 1998) below land surface. The daily average water levels during 1998 (table 7) ranged from 41.48 ft (February 3 and April 11) to 41.87 ft (December 7 and December 21) below land surface.

Other

Two monitoring sites (AM-5 and AM-7) also are instrumented to continually collect water-level data as part of USGS, Nevada District programs; those data are collected, processed, and reviewed by personnel associated with this program and can be obtained from their principal investigators.

Ground-Water Discharge Data

Measurements of ground-water discharge were collected and compiled for five springs and one flowing well (AM-2). Four of the sites, AM-1a, AM-2, AM-5a, and AM-8, are in the Ash Meadows spring-discharge area of the Amargosa Desert. The other two sites, DV-1 and DV-2, are in Death Valley. Discharge measurements were made by NPS, USFWS, and USGS-EMP. Periodic and monthly mean discharge data were determined by the use of current meters, flumes, and volumetric techniques.

The most commonly used method for measuring discharge, indicated by method "C" in table 8, was the vertical-axis current meter. This method is used to determine the average velocity of a partial section within a channel cross section. The average velocity within the partial section times the area of the partial section equals the discharge of that section. The summation of the discharges for all the partial sections is the total discharge in the channel. This method is described in more detail by Buchanan and Somers (1969).

Some discharge values were determined by measuring the depth of water inside a flume. The depth, or stage, is compared to an applicable stage-discharge relation for the flume to determine discharge. This method, indicated by method "F" in table 8, was used for site AM-1a. Determining discharges by the use of flumes is further described by Kilpatrick and Schneider (1983). Where an instrument has been installed to con-

tinually record stage in a flume, mean discharges can be computed for specific periods. This method is indicated in table 8 by method "Z" and was used for site DV-1, where monthly mean discharge (reported for the 15th of the month) was computed on the basis of daily data collected by NPS.

The volumetric method, indicated by method "V" in table 8, was used for measuring ground-water discharge from sites AM-2 and DV-2. A container was used to collect all discharge from the site while a stopwatch was used to determine the amount of time the discharge was collected. The container was positioned to collect the discharge and the stopwatch was started simultaneously. The container was removed, before it was overfilled, and the stopwatch was stopped simultaneously. The volume collected and elapsed time were determined; the discharge rate is the volume collected divided by the time. This procedure was repeated three times and an average rate was computed for each site visit.

The accuracy of the methods is directly related to the operational conditions of the equipment used and to the environmental conditions in which the equipment operated. Discharge values are reported to two significant figures. Discharge determined by all methods ranged from 0.90 gal/min at site DV-2 to 3,400 gal/min at site AM-5a for 1998 (table 8).

Ground-Water Withdrawal Data

Estimated ground-water withdrawals from wells for calendar year 1998 are presented in table 9 and historical annual withdrawals in figures 10 and 11 by their location in the ground-water subbasin and hydrographic area of the study area. The Alkali Flat-Furnace Creek Ranch and the Ash Meadows ground-water subbasins cover the study area. Ground-water withdrawals are totaled from the Amargosa Desert, Crater Flat, Jackass Flat, and Mercury Valley hydrographic areas. The Amargosa Desert spans both subbasins and is subdivided into two areas within the Ash Meadows groundwater subbasin.

Withdrawals were estimated from compiled data supplied by public agencies including DOE, USGS, and NDWR. Ground-water withdrawals also were compiled from information provided by private organizations including Bechtel Nevada and Daisy Gold Mining Company.

Estimated annual ground-water withdrawals are based solely on available data and may be underestimated. Only when most of the withdrawals for an area were available, was an estimate made. In figures 10 and 11, when no bar is shown, it reflects that no estimate could be made, rather than an estimate of no withdrawals.

Withdrawals from Alkali Flat-Furnace Creek Ranch Ground-Water Subbasin

Withdrawals from the part of the Amargosa Desert hydrographic area within the Alkali Flat-Furnace Creek Ranch ground-water subbasin were recompiled from ground-water pumpage inventories taken by NDWR. The pumpage inventories were for the entire Amargosa Desert during 1998, and include estimated withdrawals for irrigation, mining, quasi-municipal and commercial, and domestic uses. All reported withdrawals for mining use are from the Alkali Flat-Furnace Creek Ranch ground-water subbasin. Almost all reported withdrawals for irrigation (about 99.9 percent) and quasi-municipal and commercial uses (about 99.6 percent) in the Amargosa Desert also are from the Alkali Flat-Furnace Creek Ranch ground-water subbasin. Reported domestic use is based on the numbers and locations of wells drilled for domestic purposes, as stored in data bases maintained by NDWR (Robert Coache, Nevada Division of Water Resources, oral commun., 1998); about 85.2 percent of all domestic use is from the part of the Amargosa Desert within this subbasin.

Withdrawals from Crater Flat were determined from totalizing flowmeters at Gexa Well 4 (about 1.6 mi northeast of site CF-1a), well Daisy PW-2 (about 1.8 mi northeast of site CF-1a), and site CF-3. Withdrawals from Gexa Well 4 and well Daisy PW-2 are based on information supplied by the Daisy Gold Mining Company (Mike Worley, resident engineer, written commun., 1999). Withdrawal data from site CF-3 were from NDWR. Data on withdrawals from well USW VH-2 (about 1.5 mi northwest of site CF-2) were not available, although ground water is known to have been pumped from that well during 1998.

Withdrawals from Jackass Flats were determined from totalizing flowmeters at site J-13, site J-12, well UE-25c #3 (about 2.5 mi northwest of site J-13), well UE-25 WT #17 (about 2.5 mi west of site J-13), and well UE-25 WT #3 (about 1.3 mi southwest of site J-13). Withdrawals at sites J-13 and J-12 were recom-

piled from flowmeter readings supplied by Bechtel Nevada as part of the USGS Hydrologic Resources Management Program (D.B. Wood, U.S. Geological Survey, written commun., 1999). Withdrawals from wells UE-25c #3, UE-25 WT #17, and UE-25 WT #3 are based on quarterly pumpage reports provided by DOE (Wendy Dixon, U.S. Department of Energy, written communs., 1998 and 1999).

Withdrawals from Rock Valley are considered negligible on the basis of knowledge of activities in that area.

Withdrawals from Ash Meadows Ground-Water Subbasin

Withdrawals from Mercury Valley were recompiled from flowmeter readings supplied by Bechtel Nevada for site MV-1 as part of the USGS Hydrologic Resources Management Program (D.B. Wood, U.S. Geological Survey, written commun., 1999).

The Amargosa Desert within the Ash Meadows ground-water subbasin has been divided into two parts to provide information on withdrawals in the immediate vicinity of the environmentally sensitive Ash Meadows area; they are identified in table 9 and figure 11 as the Amargosa Desert (excluding Ash Meadows area) and the Amargosa Desert (Ash Meadows area). No withdrawals were reported for mining use from these two parts of the Amargosa Desert. Withdrawals for irrigation and quasi-municipal use in the Amargosa Desert (excluding Ash Meadows area) include withdrawals from three wells located in T. 17 S., R. 52 E. Withdrawals for quasi-municipal and commercial use from the Amargosa Desert (Ash Meadows area) include withdrawals from two wells located in T. 18 S., R. 50 E. Withdrawals for domestic use from the two parts of the Amargosa Desert within this subbasin were about 13.1 and 1.7 percent, respectively, of total reported domestic use in the entire Amargosa Desert hydrographic area during 1998; estimates of domestic use are on the basis of numbers and locations of wells drilled for domestic purposes (as stored in data bases maintained by NDWR).

Quality Assurance

Stringent quality assurance is required for all work pertaining to Yucca Mountain studies to establish adequate confidence in the reliability of data collection, processing, and reporting. In the context of this data-collection program, quality assurance is defined as all planned or systematic actions designed to provide data and records of a desired quality. A variety of quality-control procedures, which are the operational techniques and activities used to meet the required quality objectives, have been implemented.

The numerous management and administrative procedures that control processing, record keeping, and reporting of data by USGS-EMP are not detailed in this report. Generally, data such as location, date and time of determinations, and field measurements are recorded onsite. Those data are reviewed for completeness and accuracy, stored in project files and data bases, and are subsequently included in publications by the USGS. Following publication, data are stored in a comprehensive record-keeping facility maintained by contractors for DOE.

In addition to standard USGS practices and the procedures previously described, formal unpublished technical procedures associated with the Yucca Mountain Site Characterization Project have been developed for the collection of water-level and discharge data. Those technical procedures include equipment tests and calibrations, in addition to measurement techniques, to ensure that necessary and expected precision and accuracy are attained. The principal technical procedures that control the collection of data by project personnel are listed by La Camera and Westenburg (1994, p. 17).

PRESENTATION OF GROUND-WATER DATA

Tables included in this report generally list only 1998 ground-water data, whereas figures 2-13 show data for selected periods of record to illustrate changes in ground-water resources through time. Exceptions are tables 3, 4, and 10; tables 3 and 4 include data from 1999 used to determine correction factors for electric-tape measurements made during 1998 and table 10 includes a summary of historical water-level measurements at monitoring sites in Jackass Flats. Below is a description of the content of the tables and figures presented in this report.

Tables 5–9 list ground-water data that have been collected and compiled in the Yucca Mountain region as part of this study; they are included at the back of this report. Figures 2–11 are hydrographs and other graphical representations of selected data from the tables in this and previous reports on selected ground-water data for the Yucca Mountain region.

Pumping of water from or injecting water into a well or nearby well may result in short-term variations in water levels that differ from long-term or sustained ground-water levels. Observations about such activities (noted by field personnel during site visits) and corresponding water levels, which may represent short-term conditions, are reported for "site status" in the data tables. Data which may reflect short-term conditions, however, are excluded from the figures showing variations in water level through time.

Table 5 lists periodic measurements of depth to water and water-level altitude at 35 sites (including a flowing well) for 1998. Periodical data generally are from manual onsite measurements of depth to water. Data at site AM-4 (Devils Hole) reported as data source "NPS," however, are monthly average water levels and are based on continual water levels recorded by instrumentation that is operated by the National Park Service. Data collected by other agencies or programs are subject to revision upon further review by that agency or program.

Figures 2–5 show water levels listed in this report and previous reports on selected ground-water data for the Yucca Mountain region. Data for wells with primary contributing units of carbonate rock, volcanic rock, valley fill, and undifferentiated sedimentary rock are presented.

Tables 6 and 7 list daily average water levels at sites JF-3 and AD-6, respectively, for 1998. The daily average water levels are computed from continual water levels recorded by instrumentation at 15-minute intervals.

Figure 6 shows daily average water-level altitude and depth to water for sites JF-3 and AD-6. Daily averages are calculated on the basis of continually collected data listed in tables 6 and 7 of this report and in previous reports on selected ground-water data for the Yucca Mountain region. Data are presented for 1992 through 1998.

Table 8 lists periodic measurements of ground-water discharge at six sites for 1998. Discharge measured at site AM-2 represents a combination of flow directly through slotted casing near the land surface and leakage from the casing's annular space. The data for site DV-1 reported with data source "NPS" represent monthly average discharge on the basis of instrumentation operated by the National Park Service. Discharge data collected by other agencies or programs are subject to revision upon further review by that agency or program.

Figure 7 shows measurements of ground-water discharge at sites AM-1a, AM-5a, and AM-8 through 1998, as listed in this and previous reports on selected ground-water data for the Yucca Mountain region.

Figures 8 and 9 show measurements of ground-water discharge through 1998 at sites AM-2 and DV-2, and DV-1, respectively, listed in this and previous reports on selected ground-water data for the Yucca Mountain region. Periodic USGS measurements for 1990, 1991, and 1992 that were tabulated by La Camera and
Westenburg (1994, table 5) have been revised to reflect previously unaccounted water at site DV-1.

Table 9 shows estimates of annual ground-water withdrawals from wells in the Yucca Mountain region for 1998. Estimated annual ground-water withdrawals are based solely on available data, and information on withdrawals provided by other agencies or programs are subject to revision upon further review by that agency or program. Ground-water withdrawals, in millions of gallons and in acre-feet, from water-supply wells are grouped by ground-water subbasin and totaled by hydrographic area (or part of a hydrographic area) for calendar year 1998.

Figures 10 and 11 show estimates of annual ground-water withdrawals listed in this and previous reports on selected ground-water data for the Yucca Mountain region. Shown are withdrawals for areas with available data within the Alkali Flat-Furnace Creek Ranch and Ash Meadows ground-water subbasins, respectively, through 1998.

DISCUSSION OF GROUND-WATER LEVELS AND GROUND-WATER WITHDRAWALS IN JACKASS FLATS

In Jackass Flats, ground water is withdrawn to support several DOE activities (including site characterization); if those withdrawals affect ground-water levels, the effects may be detected in Jackass Flats before they are detected elsewhere within the Yucca Mountain region. The following section discusses data on ground-water levels and ground-water withdrawals in Jackass Flats. Changes in water-level altitudes at a particular site through time, discussed in the text towards the end of this section, are described in an order generally corresponding to increasing distance of the site from water-supply wells J-13 and J-12.

Figure 12 shows water-level altitudes for seven wells in Jackass Flats and estimated annual ground-water withdrawals in Jackass Flats from 1983 through 1998. Prior to 1983, available data on ground-water withdrawals in Jackass Flats generally represent only the withdrawals from well J-12 rather than total withdrawals from Jackass Flats. For greater consistency and comparability of data on water-level altitudes, water levels in wells J-13, J-12, and JF-3 that may have been affected by pumping or recent pumping of the well (water-level measurements associated with site status "P" or "R") are excluded from figure 12.

Water-level altitudes presented are based on periodic measurements or daily average water levels (when continual data recorded by instrumentation were available for more than half the year). Water levels based on periodic measurements made during site visits (and not daily averages) are shown for all sites prior to 1985; for sites JF-1, J-13, J-11, and J-12 since 1985; for site JF-2 since 1994; and for site JF-3 prior to May 1992. Daily average water levels from the U.S. Geological Survey Site-Characterization Program (R.P. Graves and J.M. Gemmell, U.S. Geological Survey, written communs., 1995–8) are shown for site JF-2 for 1985–93 and site JF-2a for 1985–97. Continual data collection at site JF-2 was discontinued in June 1994 and only periodic water levels are shown following December 1993. Continual data collection at site JF-2a was discontinued in October 1997 and only periodic water levels are shown following October 1997. Daily average water levels also are shown for site JF-3 from May 1992 through December 1998; long-term monitoring and continual data collection at this site began in May 1992.

Total ground-water withdrawals in 1998 consisted primarily of combined pumpage from water-supply wells J-13 and J-12 and test well UE-25c #3 (about 2.5 mi northwest of well J-13), which penetrate volcanic rock. About 42.5, 5.1, and 1.1 Mgal, respectively, were withdrawn from those three wells during 1998. Total ground-water withdrawals in Jackass Flats, from 1983 through 1998, are from data presented in this and previous reports on selected ground-water data for the Yucca Mountain region.

Total 1998 withdrawals in Jackass Flats were about 48.8 Mgal. Ground-water withdrawals during 1998 were about 56 percent less than withdrawals during 1997 and about 6 percent less than the median withdrawal of 52 Mgal for 1983 through 1991 (La Camera and Westenburg, 1994, p. 30).

Table 10 lists selected statistics derived from data shown in figure 12 for water-level altitudes in Jackass Flats. Data for wells JF-1, JF-2, JF-2a, J-13, J-11, J-12, and JF-3 are summarized for the selected baseline periods and for subsequent calendar years through 1998. The table shows the number of measurements; the minimum, maximum, and median water-level altitude; and the average deviation of measured water-levels about the median water level for each period.

To minimize effects of variability in measurement frequency on median water-level altitudes calculated for the period prior to 1992, the selection of a baseline period for each site was based on (1) the maximum number of consecutive years for which water-level measurements are available and (2) consecutive years containing approximately similar frequencies of water-level measurements. For consistency, the baseline period selected at instrumented wells JF-2 and JF-2a was the period following installation of continual recorders. The baseline period for JF-3 was based solely on the availability of daily average water levels from the continual data recorder, which was installed in May 1992. These baseline periods are the standard to which following years are compared.

The median water-level altitudes shown in table 10 indicate a statistically representative ground-water level for a particular time. The median of water-level measurements is listed because the calculated median is less affected by a few high or low values than is the arithmetic mean. When more than half a year of continual data at a site were available (recorded hourly or more frequently by instrumentation), the median of daily average water levels is listed.

The average deviation indicates the dispersion of the individual measurements about the median; it provides an indication of how precisely the median approximates a typical water-level altitude during the period. The average deviation equals the sum of the absolute differences between individual measurements and the median, divided by the number of individual measurements.

Figure 13 shows the median water-level altitudes and the average deviation of the water levels for wells JF-1, JF-2, JF-2a, J-13, J-11, J-12, and JF-3 for baseline periods and for subsequent years through 1998. Shown also are median ground-water withdrawals in Jackass Flats for 1983–91 and withdrawals for subsequent years through 1998. Selected information presented in the figure is summarized in the following discussion.

Median water-level altitude in water-supply well J-13 is 2,390.0 ft above sea level for the baseline period. Median water-level altitude in well J-13 for 1998 was 2,389.8 ft, which is 0.2 ft higher than for 1997 and 0.2 ft lower than that for the baseline period. The decrease in median water-level altitude between the baseline period and 1998 is identical to the apparent precision of the median for the baseline period (as indicated by the average deviation for 1989–91).

Median water-level altitude in water-supply well J-12, which is 3.0 mi south of J-13, is 2,388.3 ft for the baseline period. Median water-level altitude in well J-12 for 1998 was 2,388.0 ft, which is identical to the median water level for 1997 and is 0.3 ft lower than the median water level for the baseline period. The amount of change in median water-level altitude between the baseline period and 1998 is greater than the calculated precision (average deviation) of the median for 1990–91.

Median water-level altitude in well JF-3, which is 0.5 mi south of water-supply well J-12 and penetrates volcanic rock, is 2,388.3 ft for the baseline period. Median water-level altitude for 1998 was 2,388.0 ft; which is equal to the median water-level altitude for 1997 and 0.3 ft lower than the median water level for the baseline period. The decrease in median water-level altitude between the baseline period and 1998 exceeds the apparent precision of the median for 1992–93.

At wells J-13, J-12, and JF-3 (which penetrate volcanic rock and also are at or near principal points of ground-water withdrawals from volcanic rock) calculated declines in median water-level altitudes for 1998 are greater than or equal to the historical variability of water levels (represented by the average deviation for their respective baseline periods). From 1992–96, annual ground-water withdrawals in Jackass Flats also have generally increased but have since declined. Relatively short (2–3 years) baseline periods for the three wells and small (0.2–0.3 ft) decreases in water levels, however, make comparisons uncertain; continued monitoring of ground-water withdrawals in Jackass Flats and water levels at wells J-13, J-12, and JF-3 should determine whether decreased water levels are sustained during or after periods of withdrawals that are greater than those for the 1983–91 period.

Median water-level altitude in well JF-2, which is 1.4 mi north of water-supply well J-13 and penetrates volcanic rock, is 2,392.1 ft for the baseline period. Median water-level altitude for 1998 was 2,392.1 ft in well JF-2, which is 0.1 ft higher than the median for 1997 and equal to the median for the baseline period. The average deviation of water levels during the baseline period 1985–91, exceeded the changes in the median water levels.

Median water-level altitude in well JF-2a, which is 2.0 mi northwest of the supply well J-13 and penetrates carbonate rock, is 2,468.6 ft for the baseline period. The median water-level altitude for 1998 was 2,470.0 ft, which is 0.5 ft higher than the median water level for 1997 and 1.4 ft higher than that for the baseline period. The increase in water level between the baseline period and 1998 exceeds the apparent precision of the median water-level altitude for 1985–91. Median water levels appear to have risen 0.1–0.2 ft/yr since 1992.

Median water-level altitude in well JF-1, which is 3.2 mi north of the water-supply well J-13 and penetrates volcanic rock, is 2,392.5 ft for the baseline period. Median water-level altitude in well JF-1 for 1998 is 2,392.5 ft, which is 0.1 ft higher than that for 1997 and equal to the altitude of the baseline period. The calculated precision of the median for 1985–91, is greater than the change in the median between 1998 and the baseline period.

Median water-level altitude in well J-11, which is 6.3 mi east of water-supply wells J-13 and penetrates volcanic rock, is 2,402.2 ft for the baseline period. Median water-level altitude in well J-11 for 1998 was 2,402.6 ft, which is equal to the median for 1997 and 0.4 ft higher than the median for the baseline

period. The amount of change in median water-level altitude between the baseline period and 1998 exceeds the calculated precision (average deviation) of the median for 1990–91. Median water levels have generally risen since 1993.

In summary, the 1998 estimated ground-water withdrawal in Jackass Flats was about 48.8 Mgal. The 1998 median water level was determined for seven wells and and compared to median water level of each well over a baseline period. The baseline period of each well varied. The 1998 median water levels at wells JF-1 and JF-2 were the same as their baseline median water levels. The 1998 median water levels at wells JF-2a and J-11 were 1.4 ft and 0.4 ft higher, respectively, than their baseline median. The 1998 median water levels at production well J-12 and a nearby observation well JF-3 were 0.3 ft lower than their baseline medians. At the other production well in Jackass Flats, well J-13, the 1998 median water level was 0.2 ft lower than its median baseline.

REFERENCES CITED

Boucher, M.S., 1994, Water levels in wells J-11 and J-12, 1989–91, Yucca Mountain area, Nevada: U.S. Geological Survey Open-File Report 94-303, 9 p.

Buchanan, T.J., and Somers, W.P., 1969, Discharge measurements at gaging stations: U.S. Geological Survey Techniques of Water-Resources Investigations, book 3, chap. A8, 65 p.

Cardinalli, J.L., Roach, L.M., Rush, F.E., and Vasey, B.J., 1968, State of Nevada hydrographic areas: Nevada Division of Water Resources map, scale 1:500,000.

Dudley, W.W., Jr., and Larson, J.D., 1976, Effect of irrigation pumping on desert pupfish habitats in Ash Meadows, Nye County, Nevada: U.S. Geological Survey Professional Paper 927, 52 p.

Fenneman, N.M, 1931, Physiography of western United States: New York, McGraw-Hill, 534 p.

Gemmell, J.M., 1990, Water levels in periodically measured wells in the Yucca Mountain area, Nevada, 1988: U.S. Geological Survey Open-File Report 90-113, 47 p.

Graves, R. P., and Goemaat, R. L., 1998, Water levels in the Yucca Mountain area, Nevada, 1995: U.S. Geological Survey Open-File Report 97-101, 92 p.

Graves, R.P., Tucci, Patrick, and Goemaat, R.L., 1996, Water levels in the Yucca Mountain area, Nevada, 1994: U.S. Geological Survey Open-File Report 95-757, 101 p.

Hale, G.S., and Westenburg, C.L., 1995, Selected ground-water data for Yucca Mountain region, southern Nevada and eastern California, calendar year 1993: U.S. Geological Survey Open-File Report 95-158, 67 p.

Harrill, J.R., Gates, J.S., and Thomas, J.M., 1988, Major ground-water flow systems in the Great Basin region of Nevada, Utah, and adjacent states: U.S. Geological Survey Hydrologic Investigations Atlas HA-694-C, 2 sheets.

Johnston, R.H., 1968, U.S. Geological Survey tracer study, Amargosa Desert, Nye County, Nevada, Part 1, Exploratory drilling, tracer well construction and testing, and preliminary findings: U.S. Geological Survey Report USGS-474-98, 64 p. Available only from National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

Kilpatrick, F.A., and Schneider, V.R., 1983, Use of flumes in measuring discharge: U.S. Geological Survey Techniques of Water-Resources Investigations, book 3, chap. A14, 46 p.

Kilroy, K.C., 1991, Ground-water conditions in Amargosa Desert, Nevada-California, 1952–87: U.S. Geological Survey Water-Resources Investigations Report 89-4101, 93 p.

La Camera, R.J., Locke, G.L., and Munson, R.H., 1999, Selected ground-water data for Yucca Mountain region, southern Nevada and eastern California, through December 1997: U.S. Geological Survey Open-File Report 98-628, 84 p.

La Camera, R.J., and Locke, G.L., 1998, Selected ground-water data for Yucca Mountain region, southern Nevada and eastern California, through December 1996: U.S. Geological Survey Open-File Report 97-821, 75 p.

La Camera, R.J., and Westenburg, C.L., 1994, Selected ground-water data for Yucca Mountain region, southern Nevada and eastern California, through December 1992: U.S. Geological Survey Open-File Report 94-54, 161 p.

La Camera, R.J., Westenburg, C.L., and Locke, G.L., 1996, Selected ground-water data for Yucca Mountain region, southern Nevada and eastern California, through December 1995: U.S. Geological Survey Open-File Report 96-553, 75 p.

Laczniak, R.J., Cole, J.C., Sawyer, D.A., and Trudeau, D.A., 1996, Summary of hydrogeologic controls on ground-water flow at the Nevada Test Site, Nye County, Nevada: U.S. Geological Survey Water-Resources Investigations Report 96-4109, 59 p.

Lobmeyer, D.H., Luckey, R.R., O'Brien, G.M., and Burkhardt, D.J., 1995, Water levels in continuously monitored wells in the Yucca Mountain area, Nevada, 1989: U.S. Geological Survey Open-File Report 93-98, 173 p.

Luckey, R.R., Lobmeyer, D.H., and Burkhardt, D.J., 1993, Water levels in continuously monitored wells in the Yucca Mountain area, Nevada, 1985–88: U.S. Geological Survey Open-File Report 91-493, 252 p.

McKinley, P.W., Long, M.P., and Benson, L.V., 1991, Chemical analysis of water from selected wells and springs in the Yucca Mountain area, Nevada and southeastern California: U.S. Geological Survey Open-File Report 90-355, 47 p.

O'Brien, G.M., 1991, Water levels in periodically measured wells in the Yucca Mountain area, Nevada, 1989: U.S. Geological Survey Open-File Report 91-178, 51 p.

———1993, Earthquake-induced water-level fluctuations at Yucca Mountain, Nevada, June 1992: U.S. Geological Survey Open-File Report 93-73, 12 p.

O'Brien, G.M., Tucci, Patrick, and Burkhardt, D.J., 1995, Water levels in the Yucca Mountain area, Nevada, 1992: U.S. Geological Survey Open-File Report 94-311, 74 p.

Robison, J.H., 1984, Ground-water level data and preliminary potentiometric surface maps, Yucca Mountain and vicinity, Nye County, Nevada: U.S. Geological Survey Water-Resources Investigations Report 84-4197, 8 p.

Robison, J.H., Stephens, D.M., Luckey, R.R., and Baldwin, D.A., 1988, Water levels in periodically measured wells in the Yucca Mountain area, Nevada, 1981–87: U.S. Geological Survey Open-File Report 88-468, 132 p.

Rush, F.E., 1968, Index of hydrographic areas in Nevada: Nevada Division of Water Resources, Information Report 6, 38 p.

Thordarson, William, Young, R.A., and Winograd, I.J., 1967, Records of wells and test holes in the Nevada Test Site and vicinity (through December 1966): U.S. Geological Survey Open-File Report TEI-872, 26 p.

Tucci, Patrick, and Burkhardt, D.J., 1995, Potentiometric-surface map, 1993, Yucca Mountain and vicinity, Nevada: U.S. Geological Survey Water-Resources Investigations Report 95-4149, 15 p.

Tucci, Patrick, Goemaat, R.L., and Burkhardt, D.J., 1996a, Water levels in the Yucca Mountain area, Nevada, 1993: U.S. Geological Survey Open-File Report 95-159, 94 p.

Tucci, Patrick, O'Brien, G.M., and Burkhardt, D.J., 1996b, Water levels in the Yucca Mountain area, Nevada, 1990–91: U.S. Geological Survey Open-File Report 94-111, 107 p.

U.S. Geological Survey, 1996, Availability of ground-water data for California, water year 1995: U.S. Geological Survey Fact Sheet FS-114-96, 2 p.

Waddell, R.K., Robison, J.H., and Blankennagel, R.K., 1984, Hydrology of Yucca Mountain and vicinity, Nevada-California—Investigative results through mid-1983: U.S. Geological Survey Water-Resources Investigations Report 84-4267, 72 p.

Westenburg, C.L., and La Camera, R.J., 1996, Selected ground-water data for Yucca Mountain region, southern Nevada and eastern California, through December 1994: U.S. Geological Survey Open-File Report 96-205, 73 p.

Winograd, I.J., and Thordarson, William, 1975, Hydrogeologic and hydrochemical framework, south-central Great Basin, Nevada-California, with special reference to the Nevada Test Site: U.S. Geological Survey Professional Paper 712-C, 126 p.

BASIC DATA

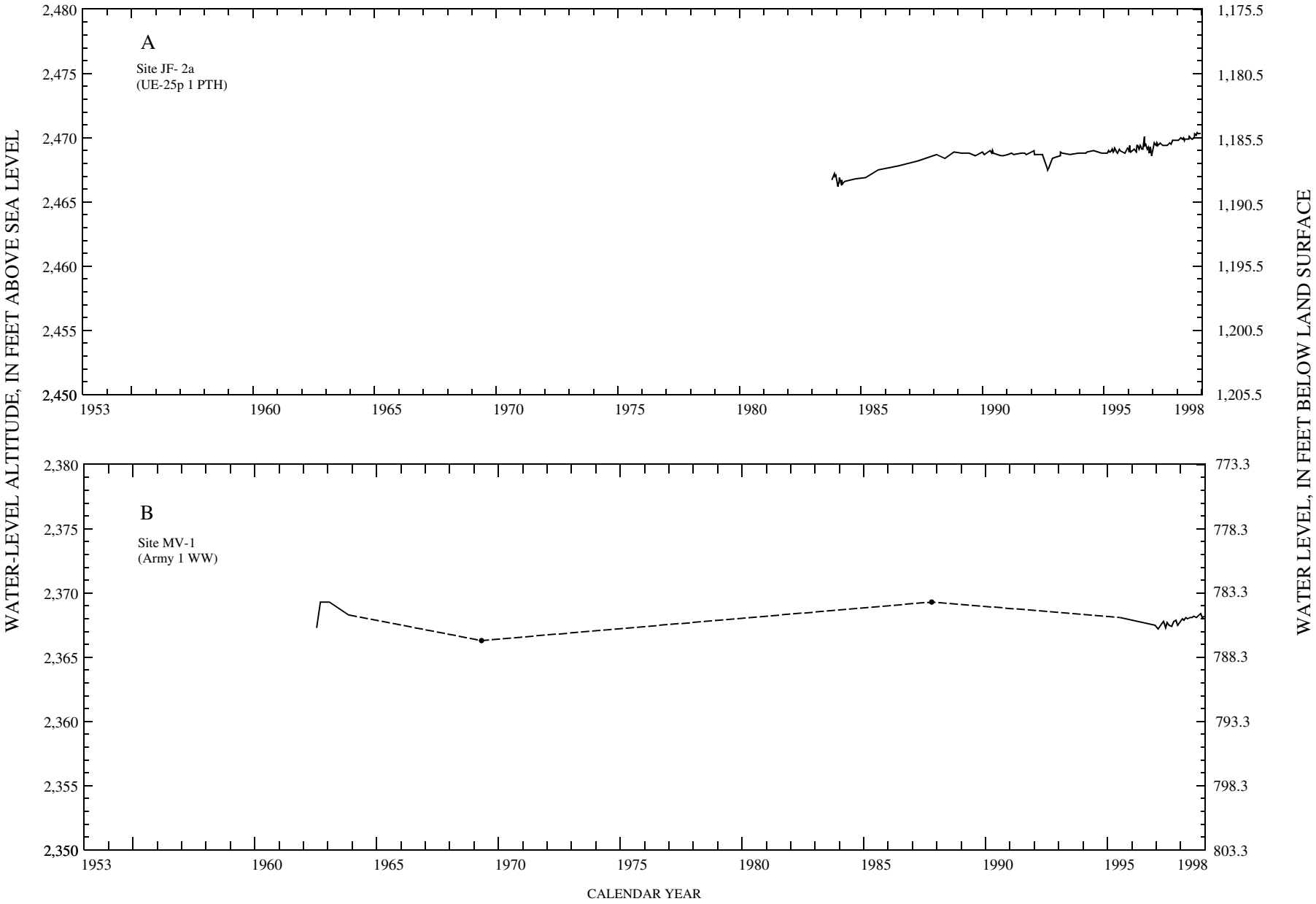

Figure 2. Periodic water levels through 1998 for selected sites at which primary contributing units are carbonate rock. Lines connect periodic data presented in this and previous reports on selected ground-water data for Yucca Mountain region. Solid lines connect yearly or more frequent measurements. Lines are dashed where measurements were not available for consecutive calendar years. A solid dot is a single isolated measurement. Data that may represent short-term conditions at a site have been excluded (see text section “Presentation of Ground-Water Data”)

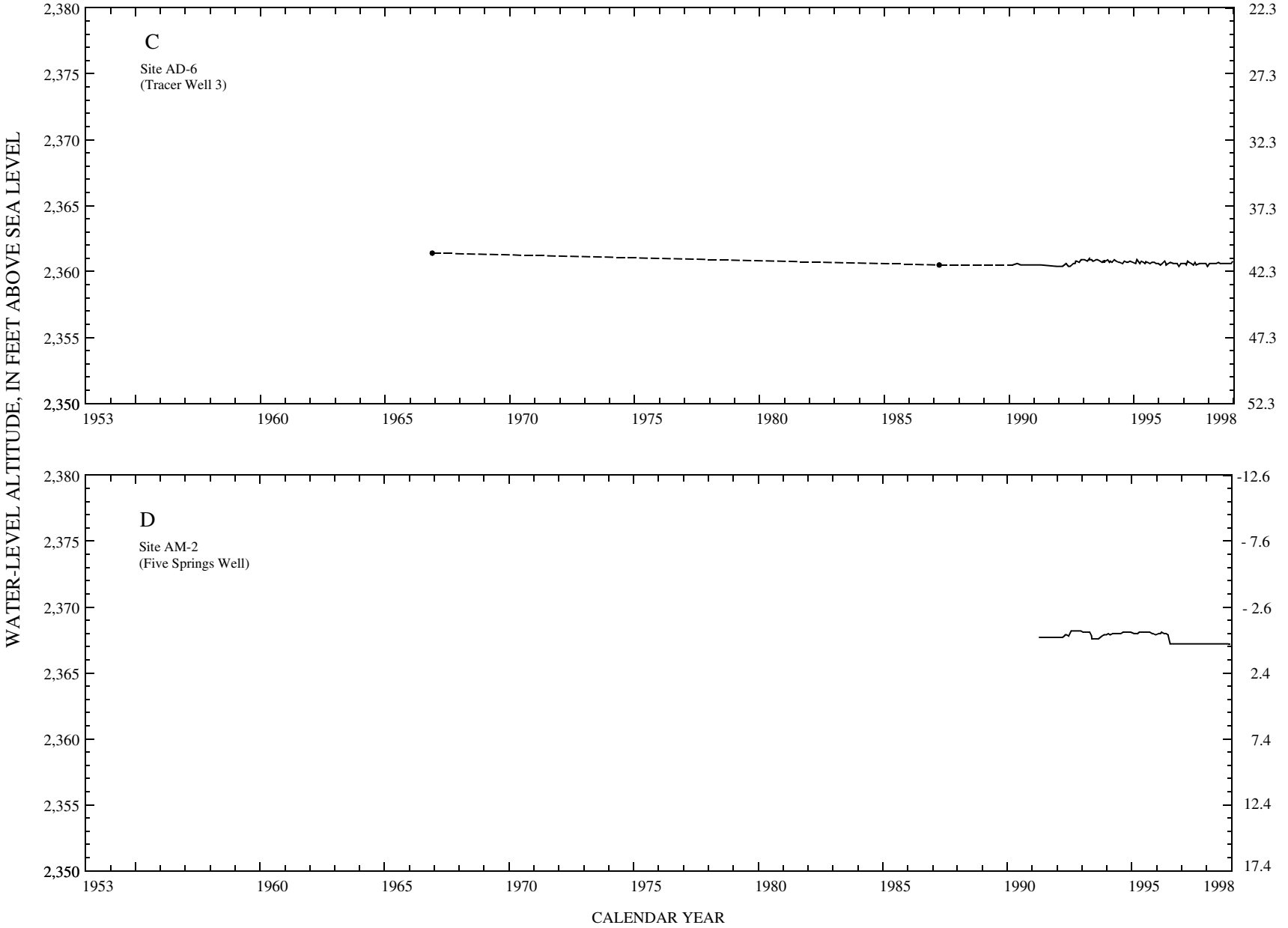

Figure 2. Continued.

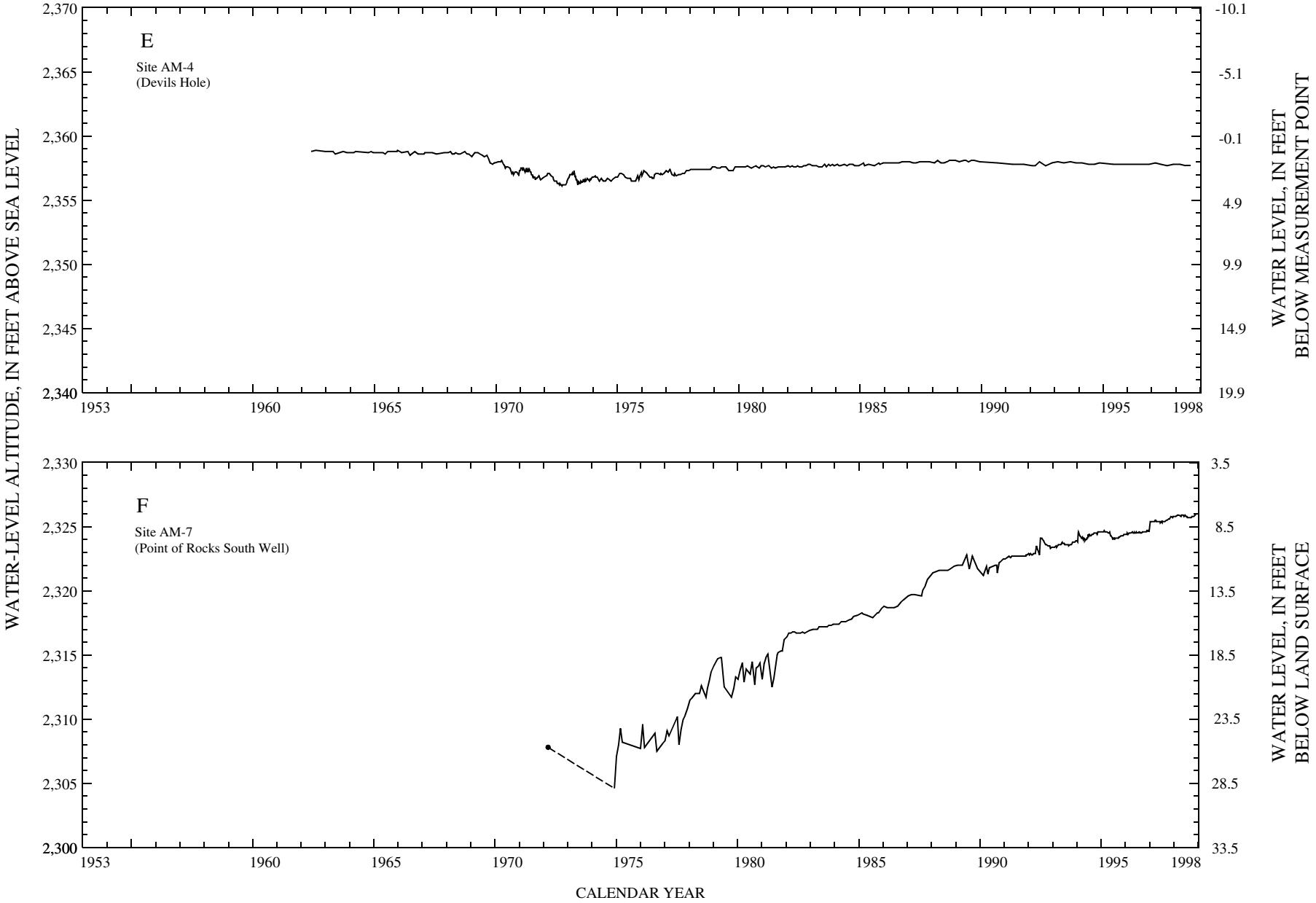

Figure 2. Continued.

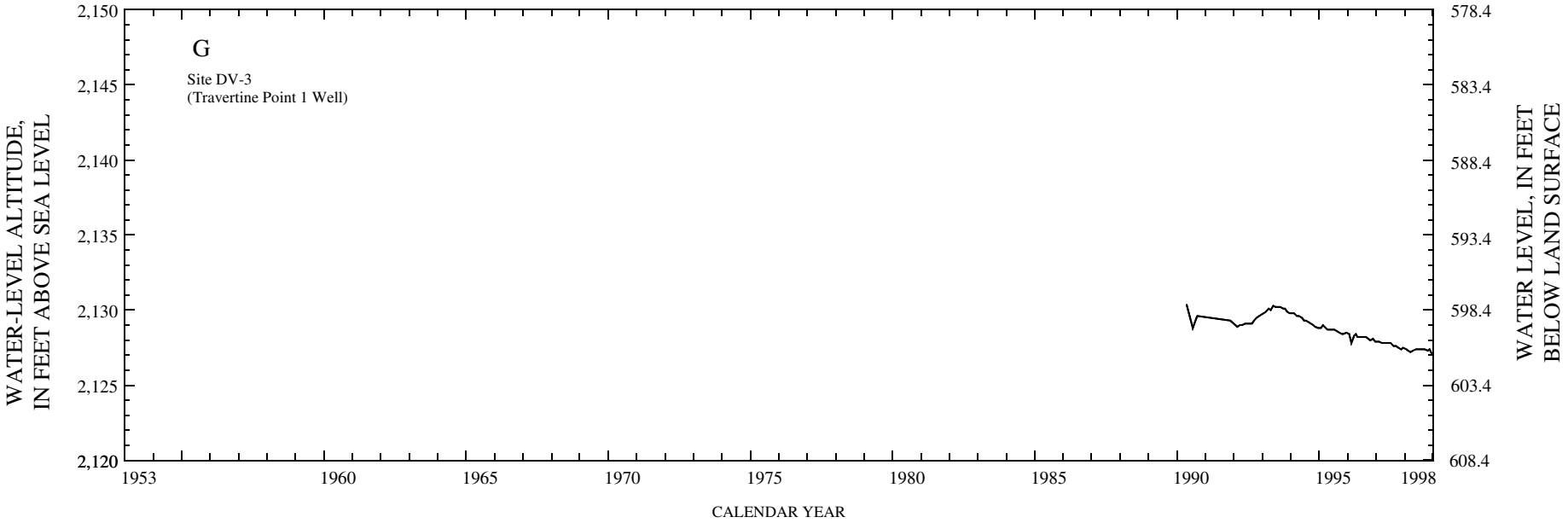

Figure 2. Continued.

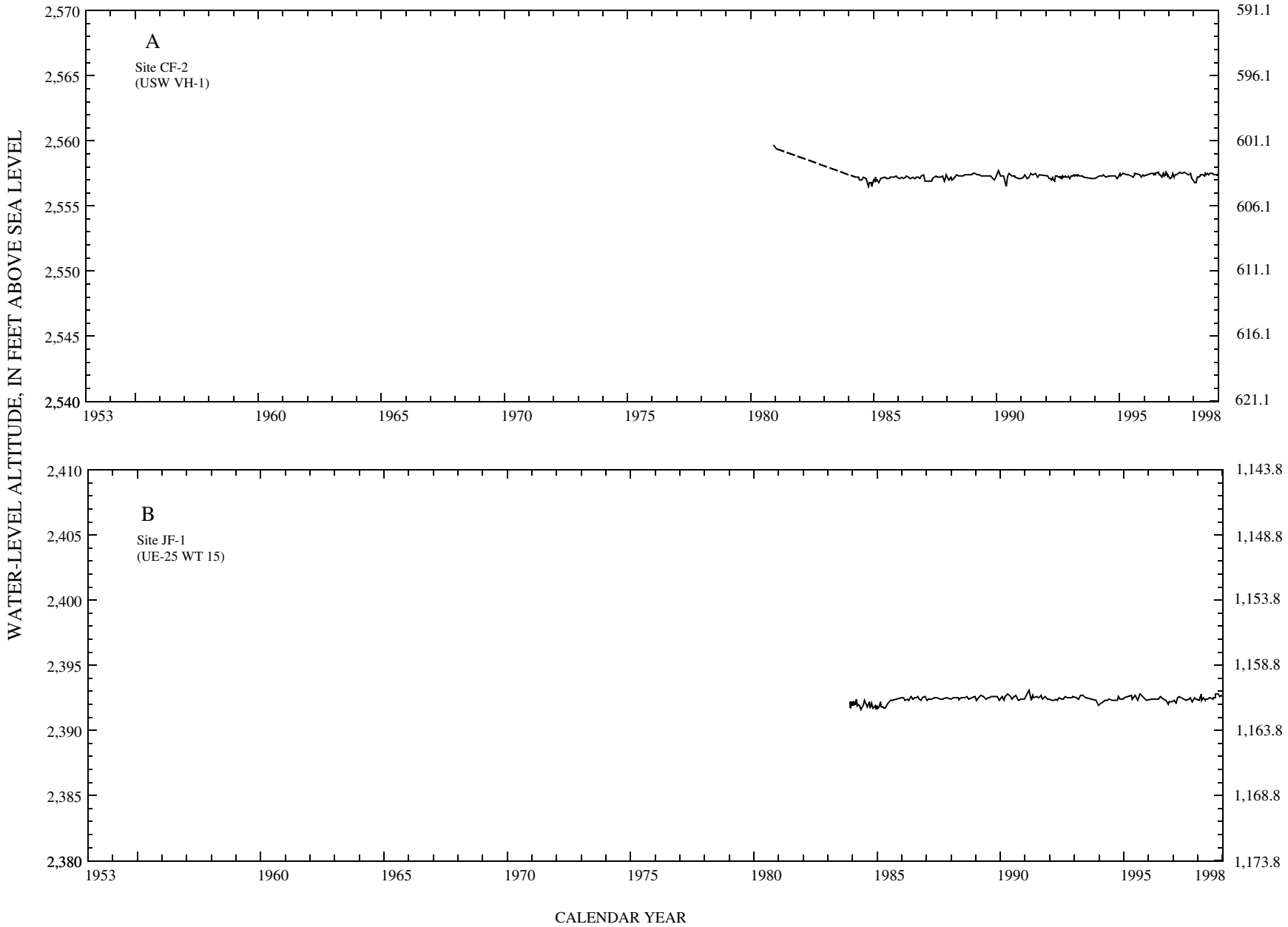

Figure 3. Periodic water levels through 1998 for selected sites at which primary contributing units are volcanic rock. Lines connect periodic data presented in this and previous reports on selected ground-water data for Yucca Mountain region. Solid lines connect yearly or more frequent measurements. Lines are dashed where measurements were not available for consecutive calendar years. A solid dot is a single isolated measurement. Data that may represent short-term conditions at a site have been excluded (see text section “Presentation of Ground-Water Data”).

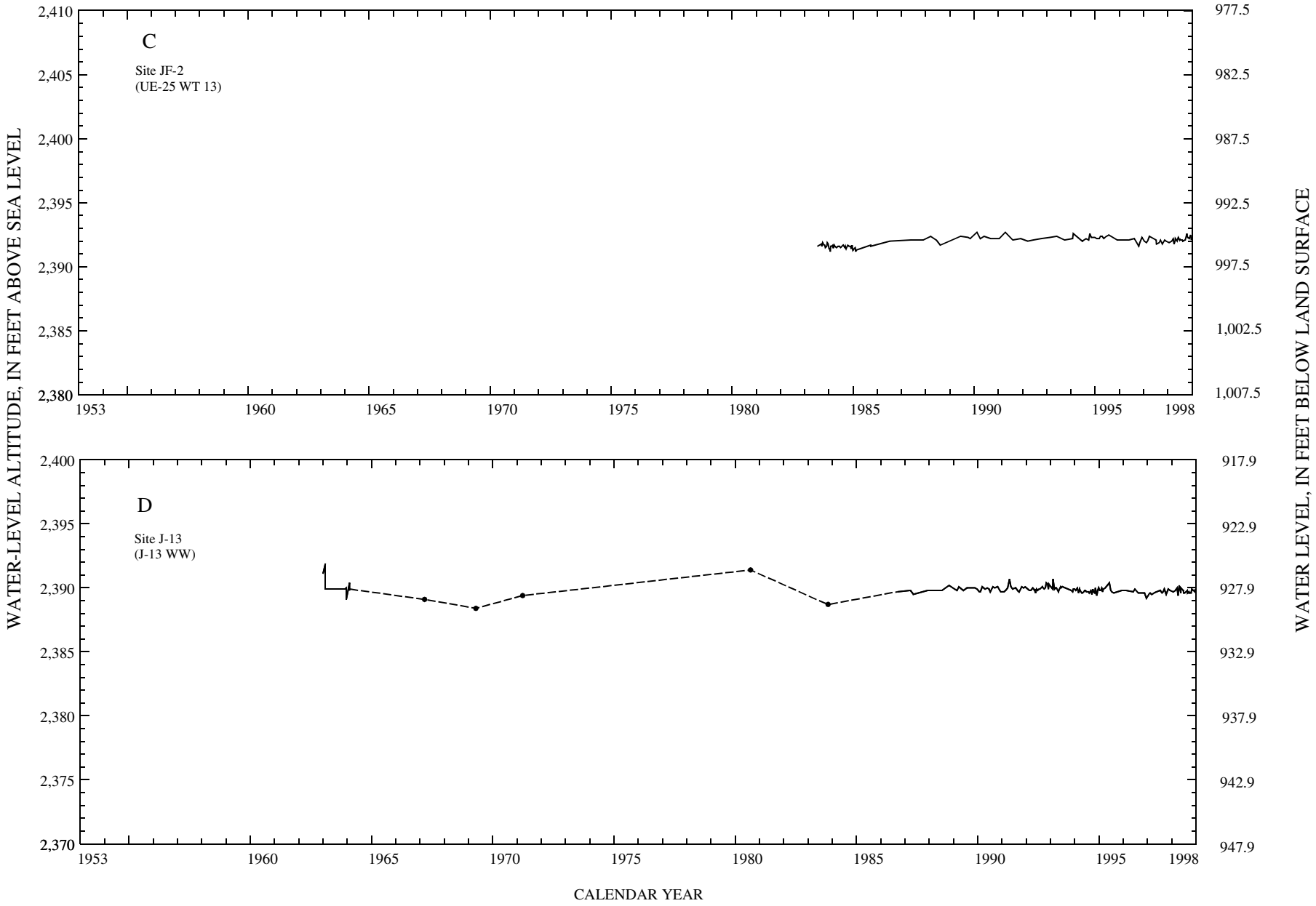

Figure 3. Continued.

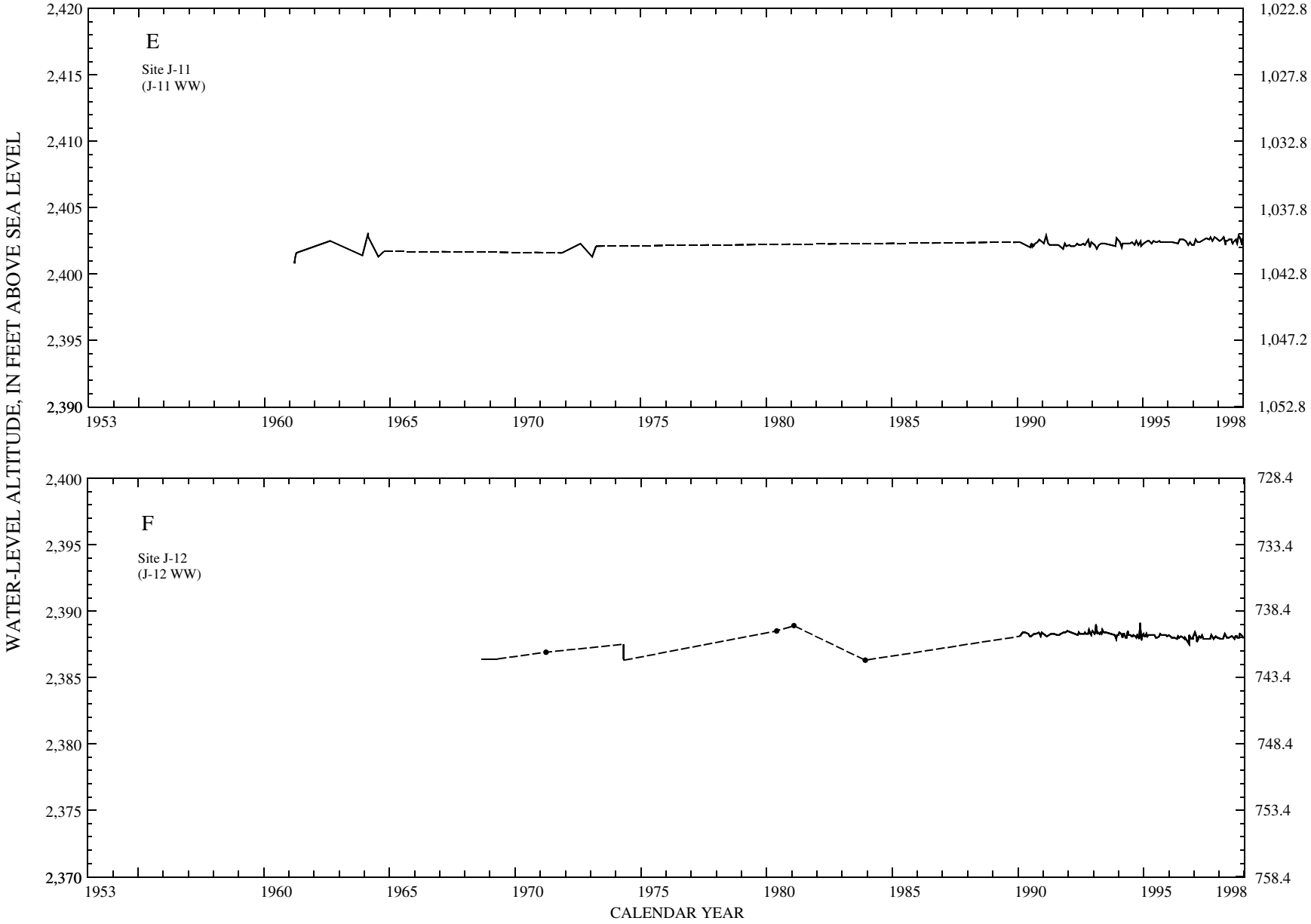

Figure 3. Continued.

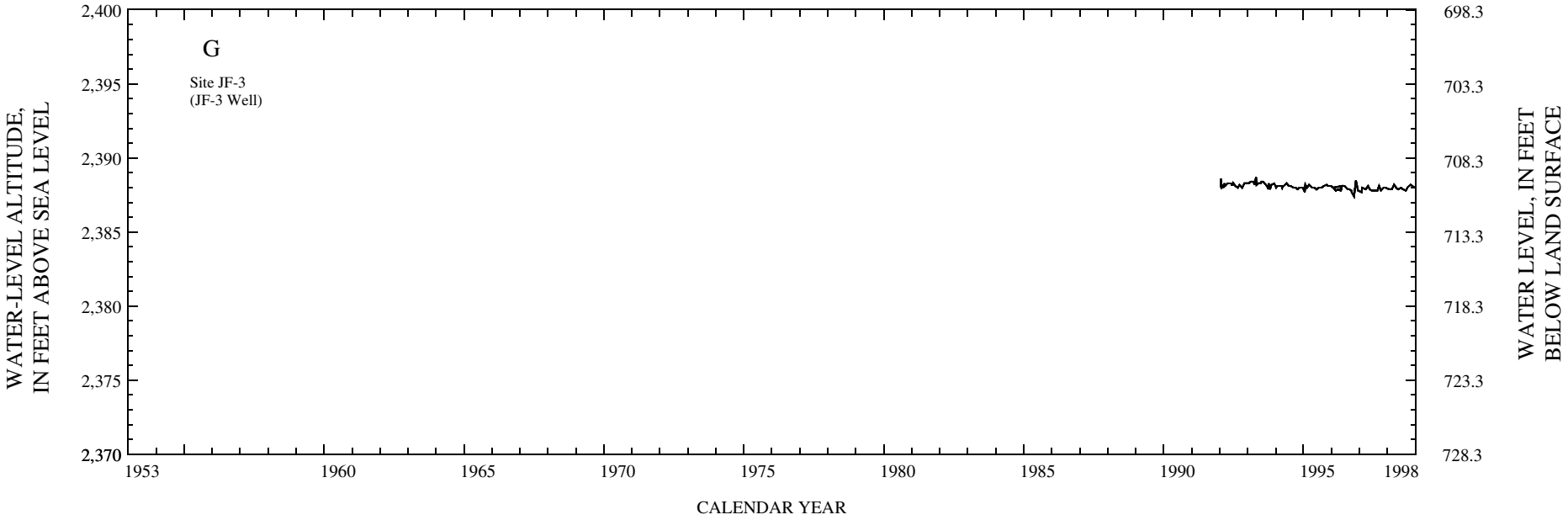

Figure 3. Continued.

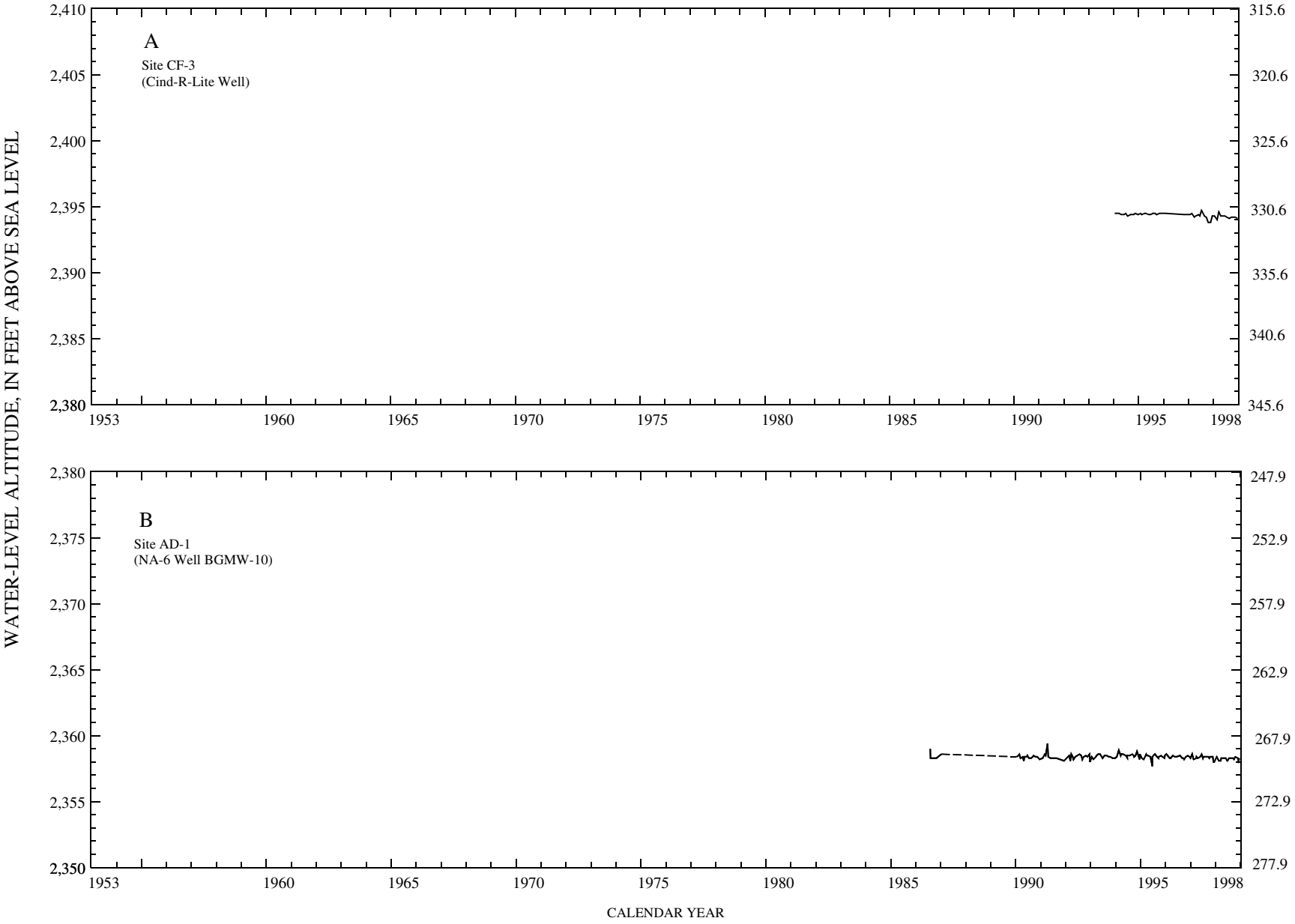

Figure 4. Periodic water levels through 1998 for selected sites at which primary contributing units are valley fill. Lines connect periodic data presented in this and previous reports on selected ground-water data for Yucca Mountain region. Solid lines connect yearly or more frequent measurements. Lines are dashed where measurements were not available for consecutive calendar years. A solid dot is a single isolated measurement. Data that may represent short-term conditions at a site have been excluded (see text section "Presentation of Ground-Water Data").

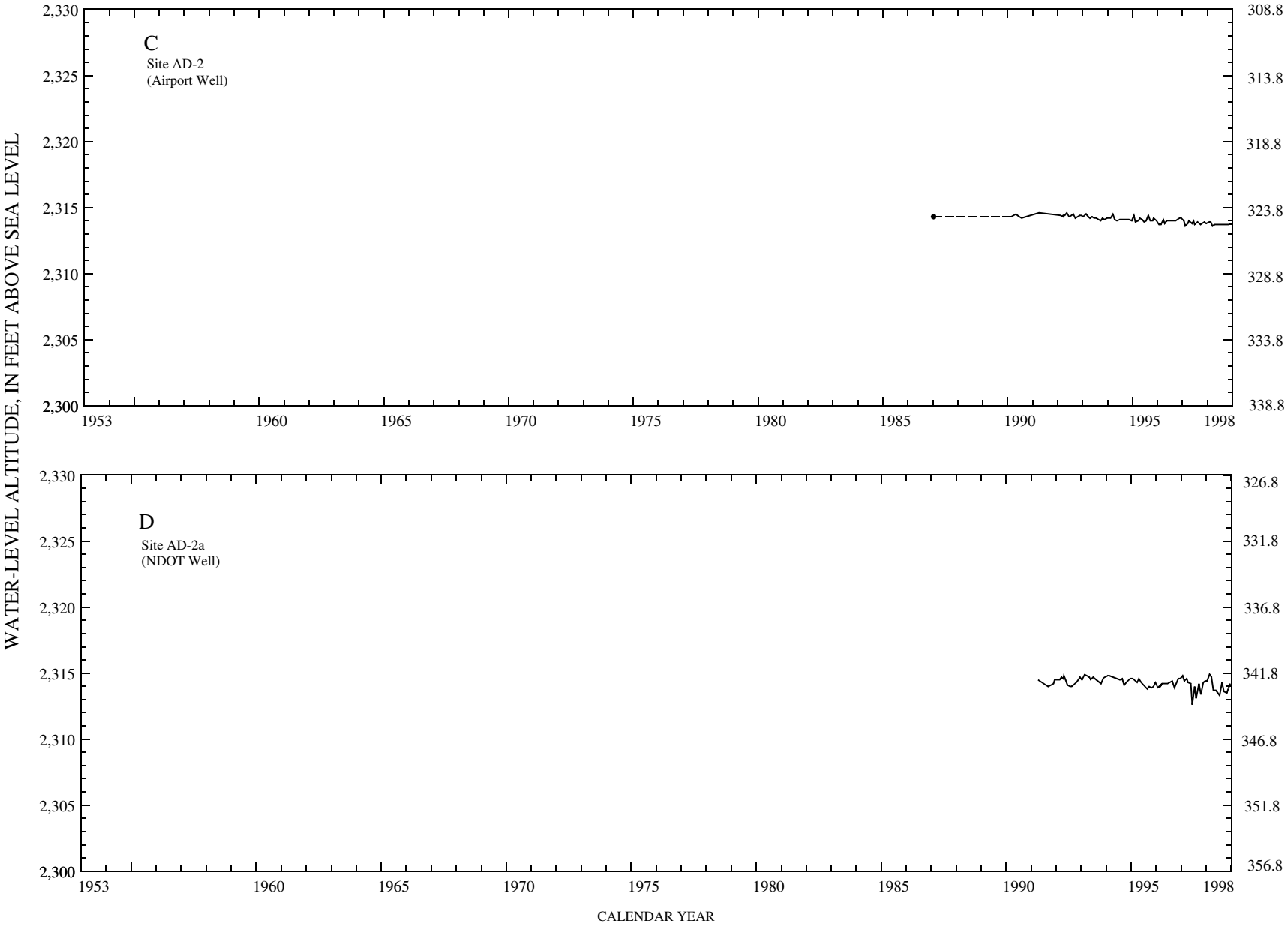

Figure 4. Continued.

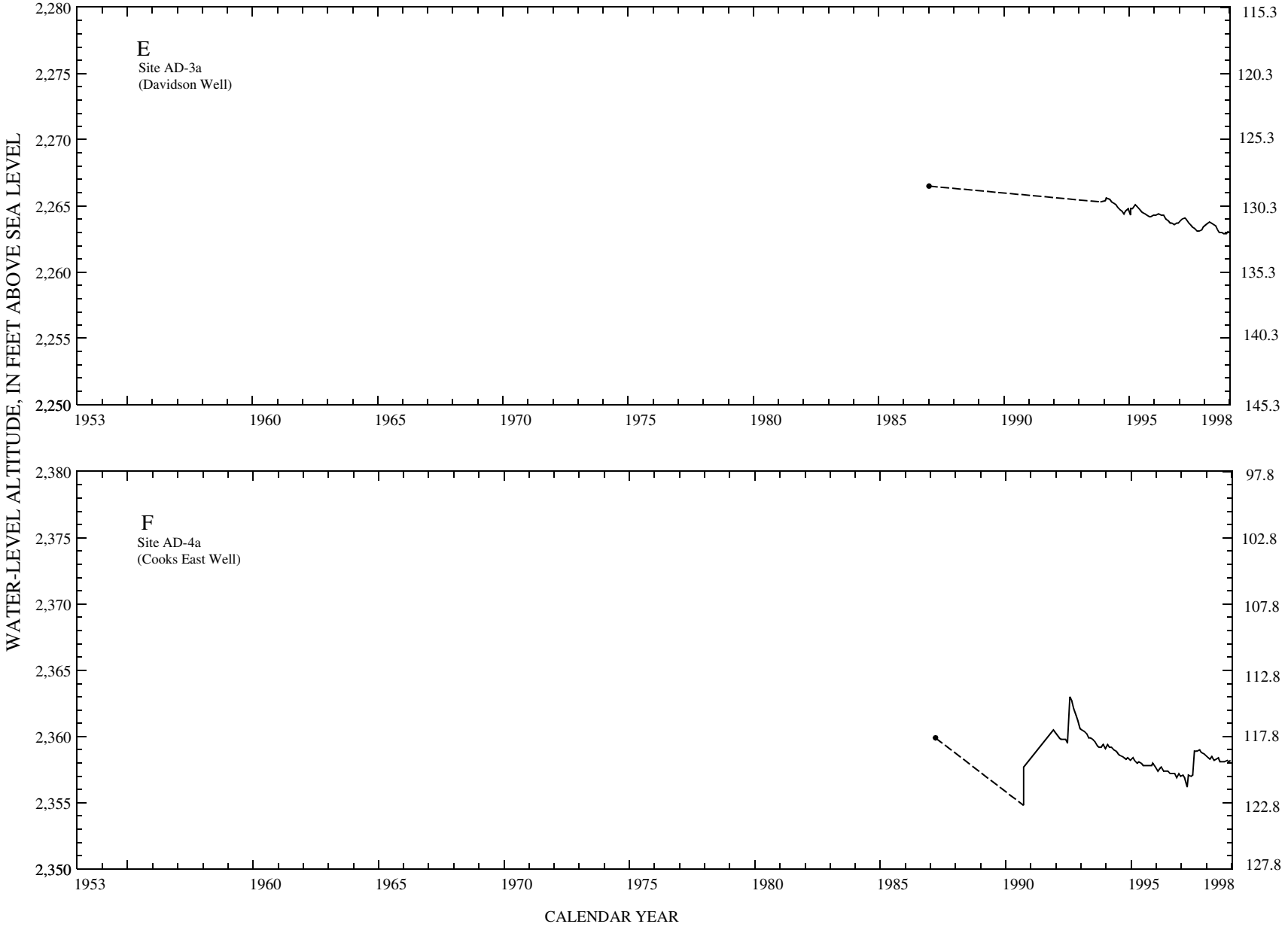

Figure 4. Continued.

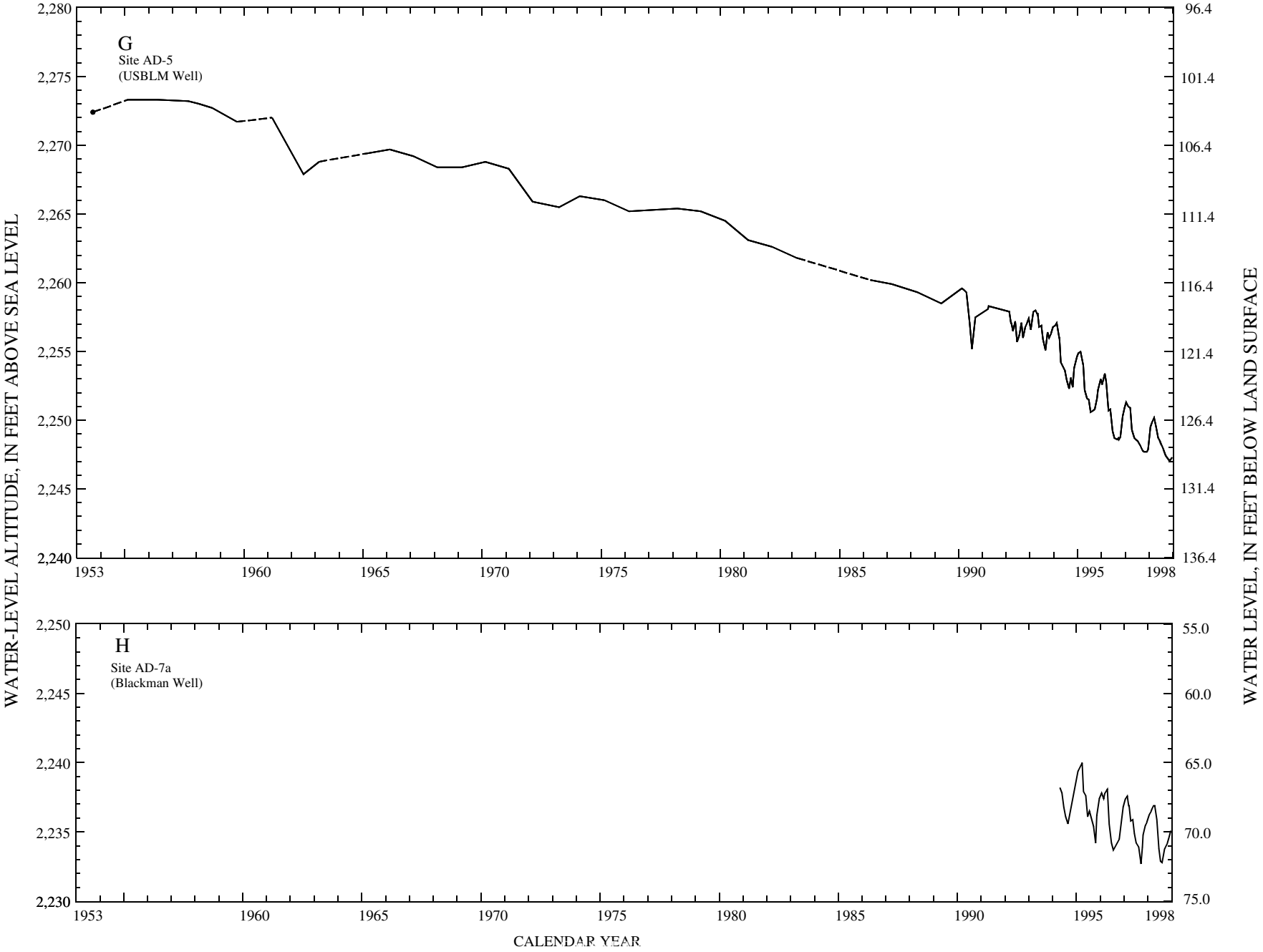

Figure 4. Continued.

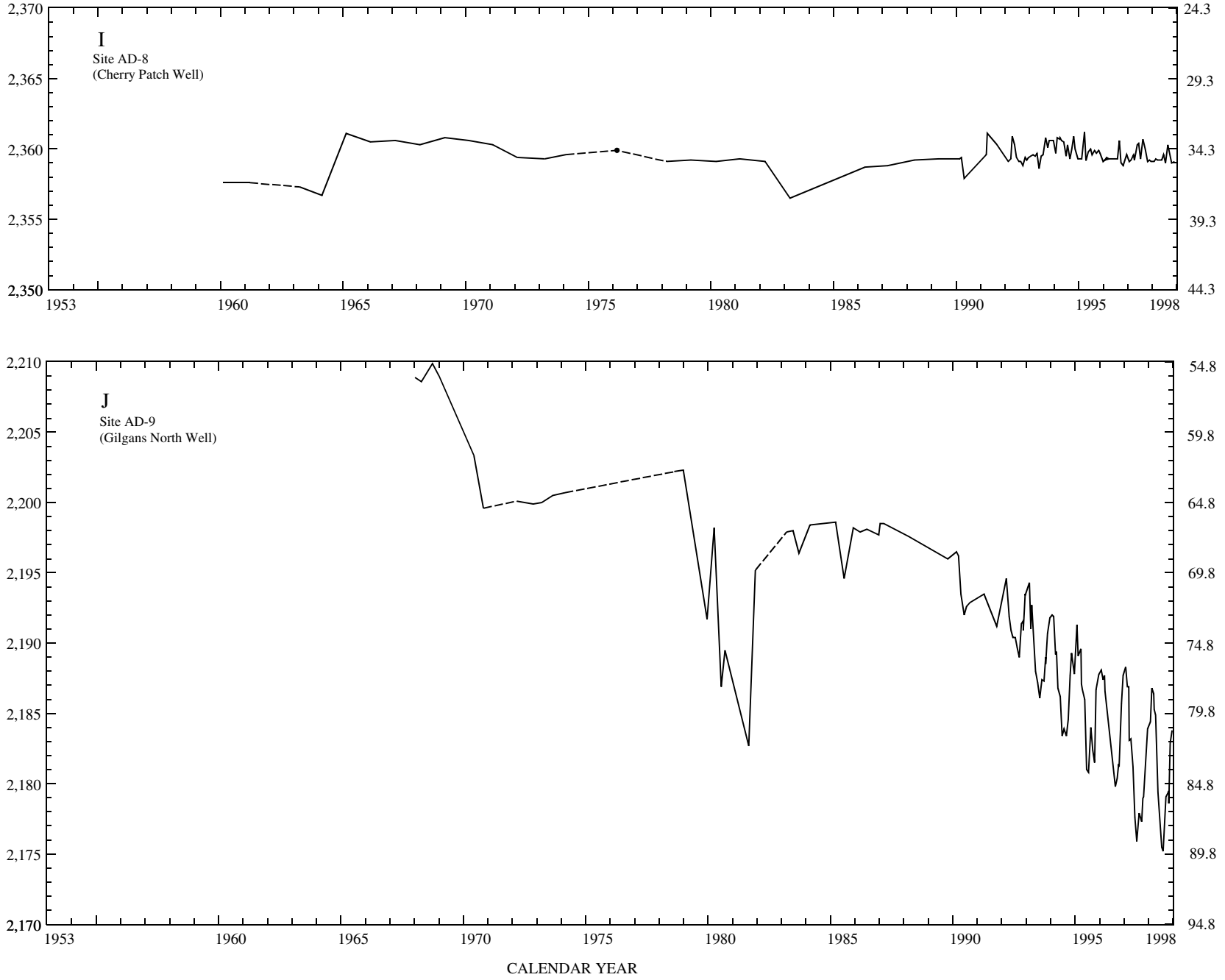

Figure 4. Continued.

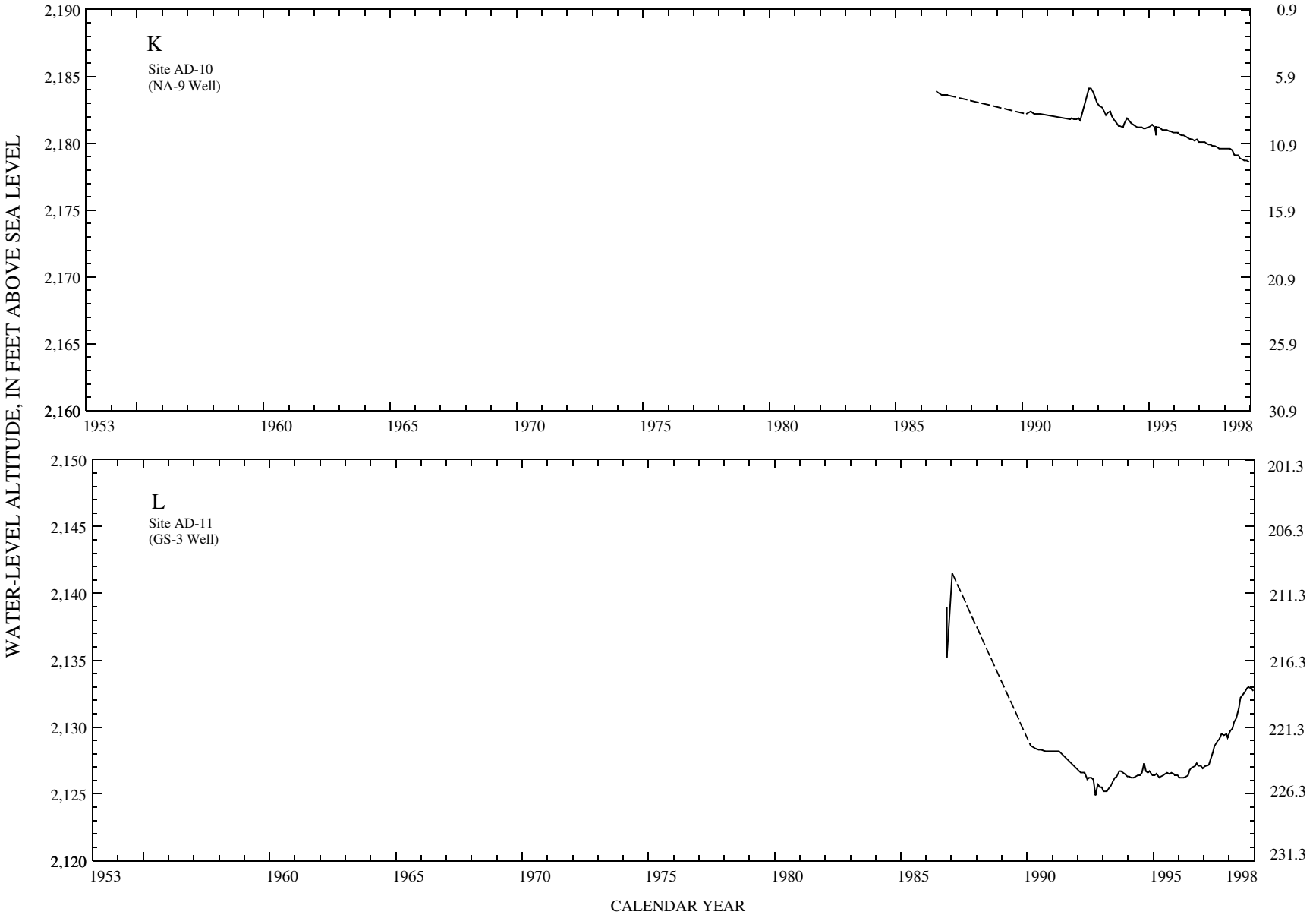

Figure 4. Continued.

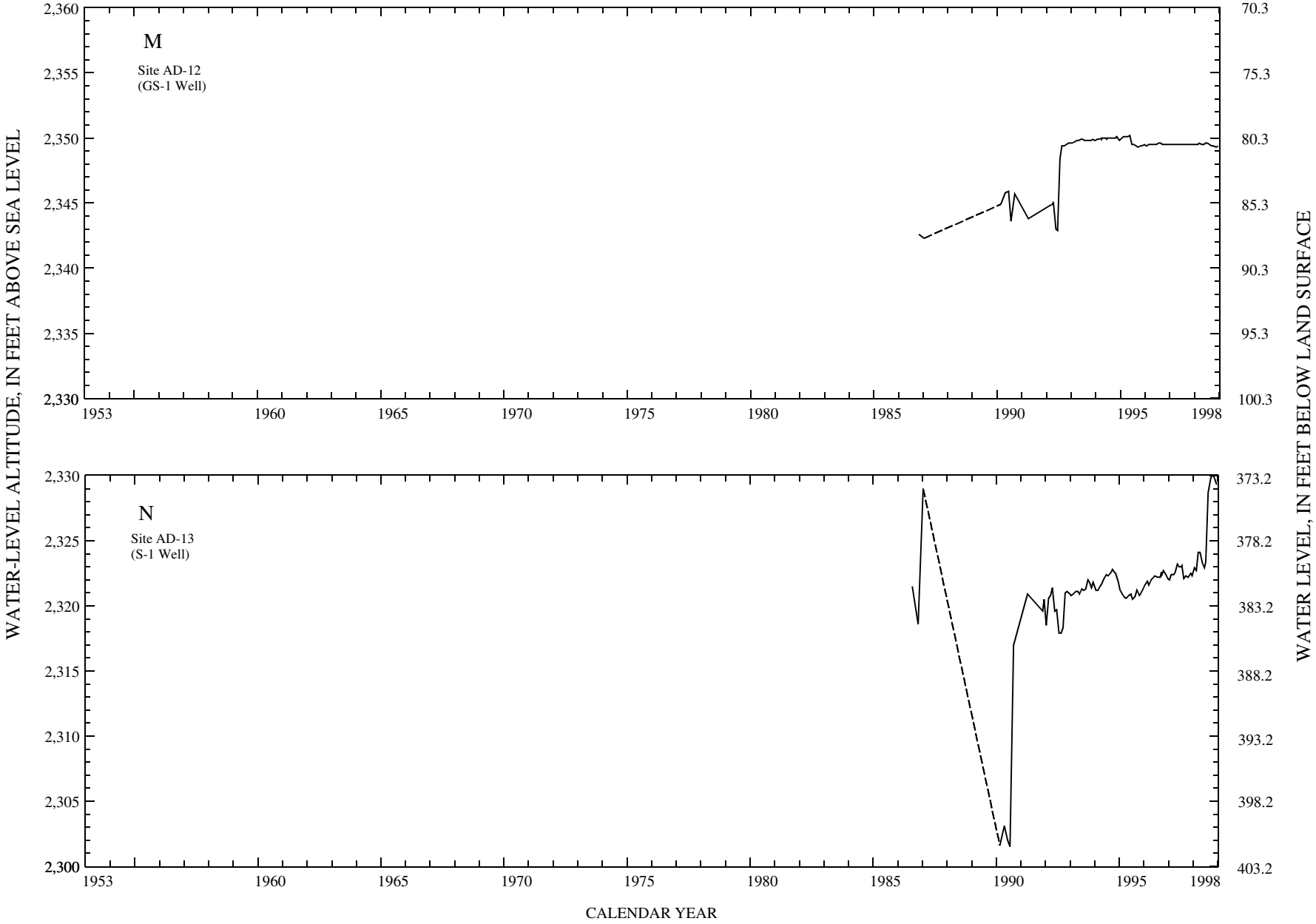

Figure 4. Continued.

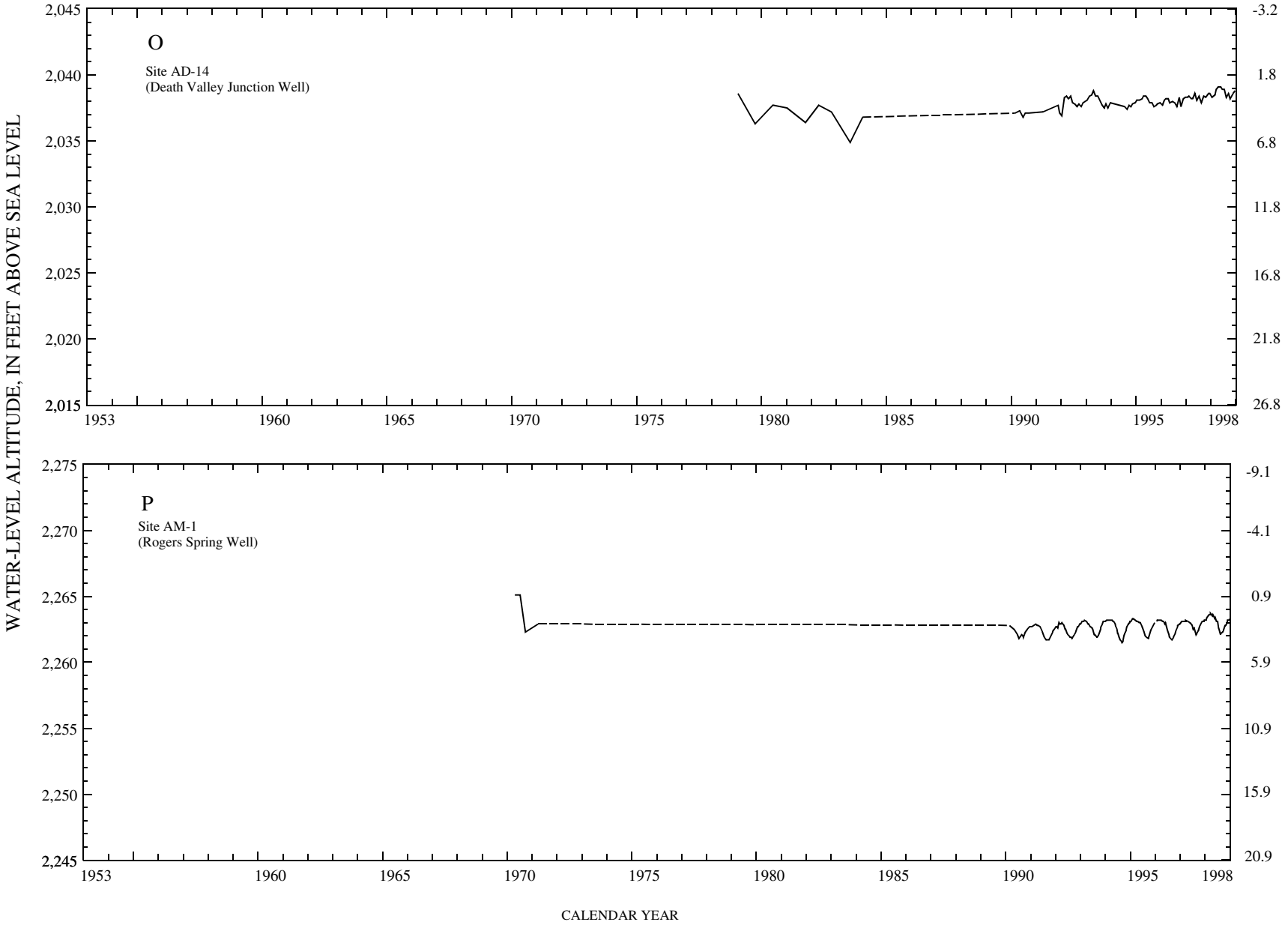

Figure 4. Continued.

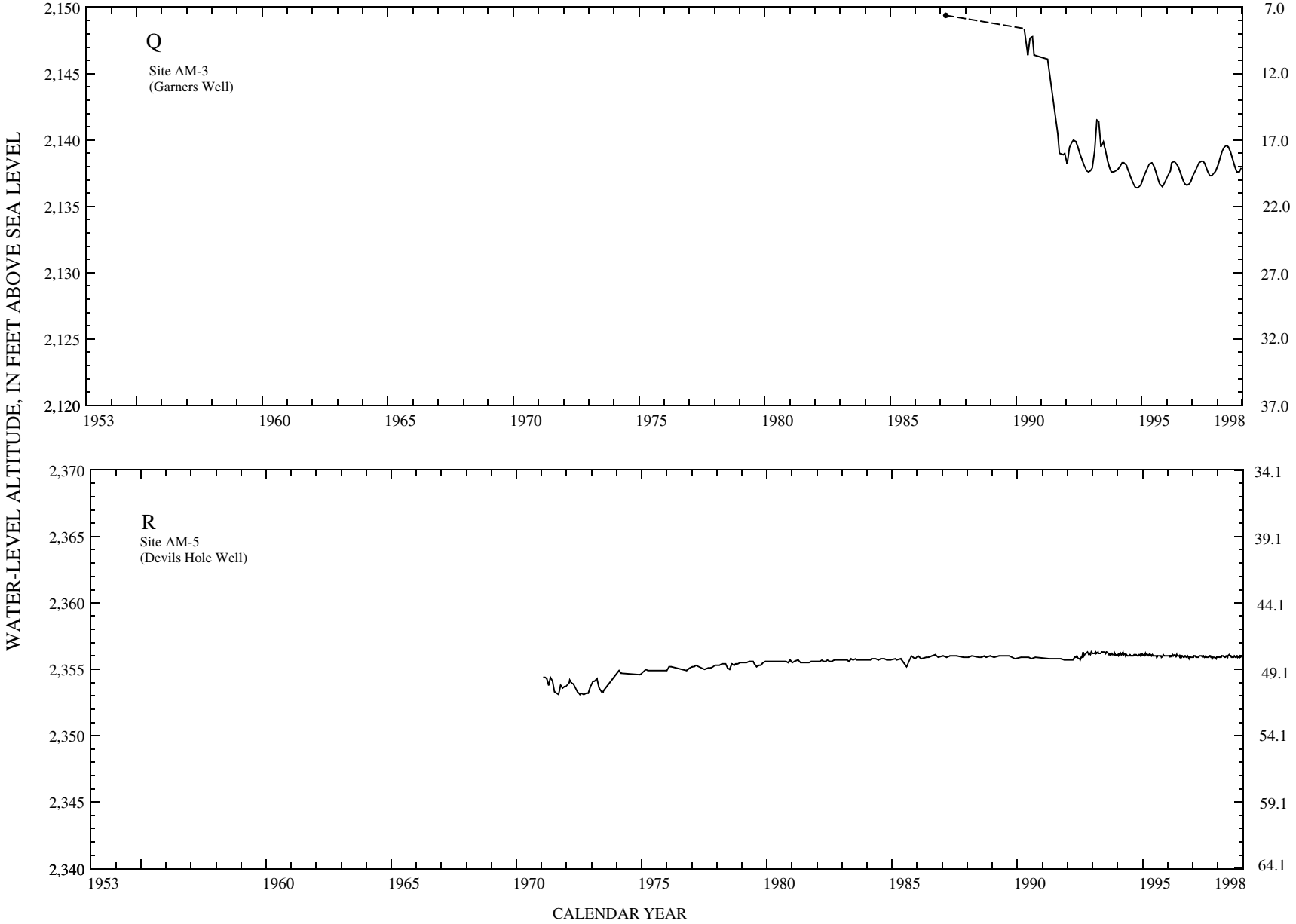

Figure 4. Continued.

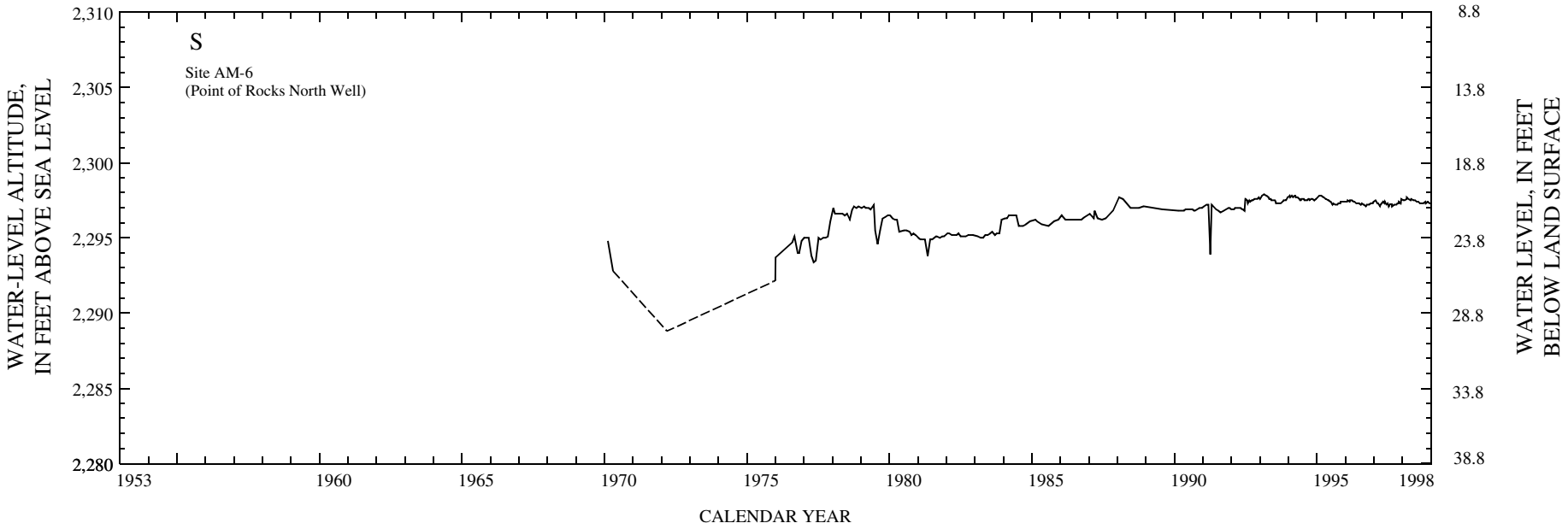

Figure 4. Continued.

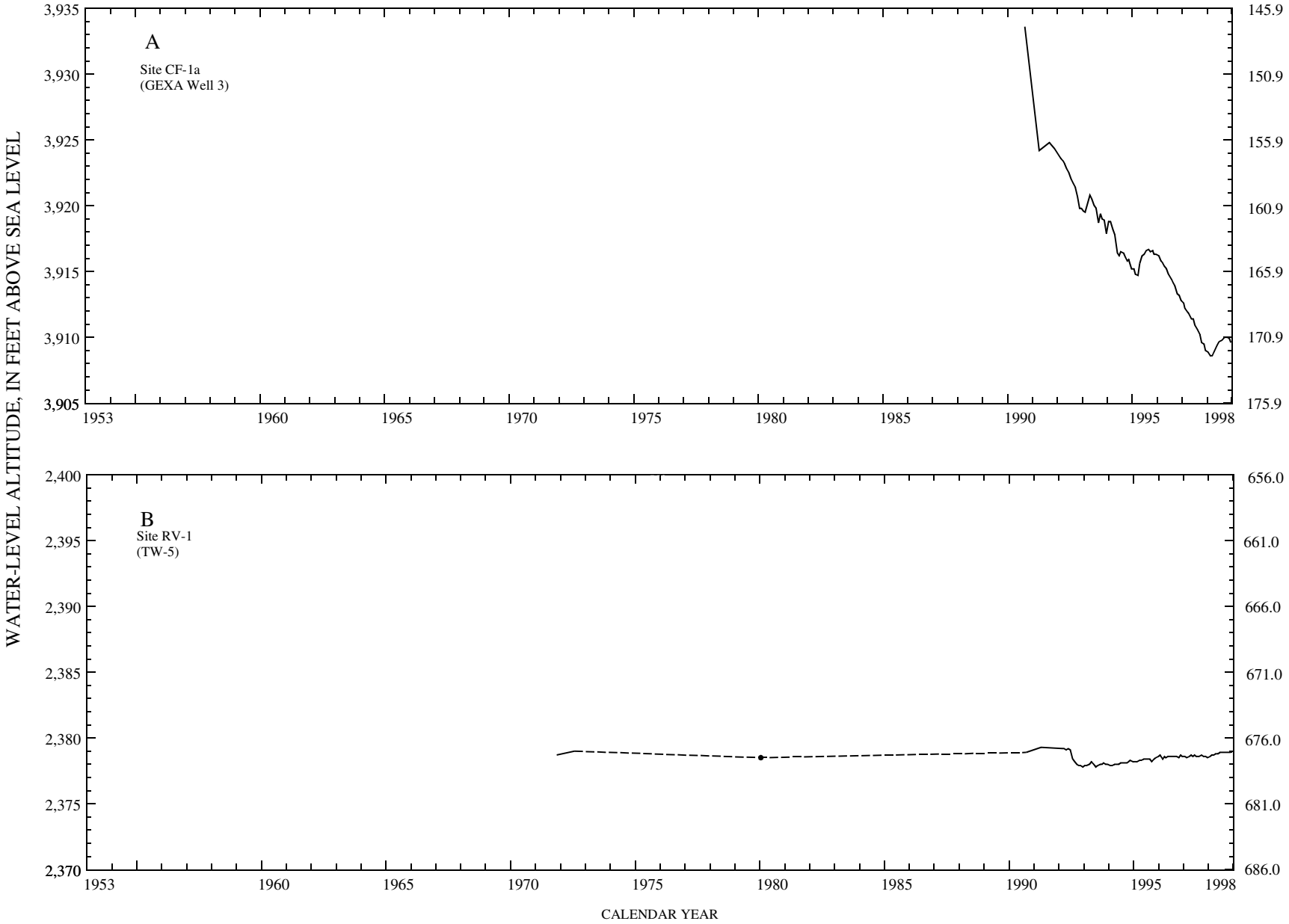

Figure 5. Periodic water levels through 1998 for selected sites at which primary contributing units are undifferentiated sedimentary rock. Lines connect periodic data presented in this and previous reports on selected ground-water data for Yucca Mountain region. Solid lines connect yearly or more frequent measurements. Lines are dashed where measurements were not available for consecutive calendar years. A solid dot is a single isolated measurement. Data that may represent short-term conditions at a site have been excluded (see text section "Presentation of Ground-Water Data").

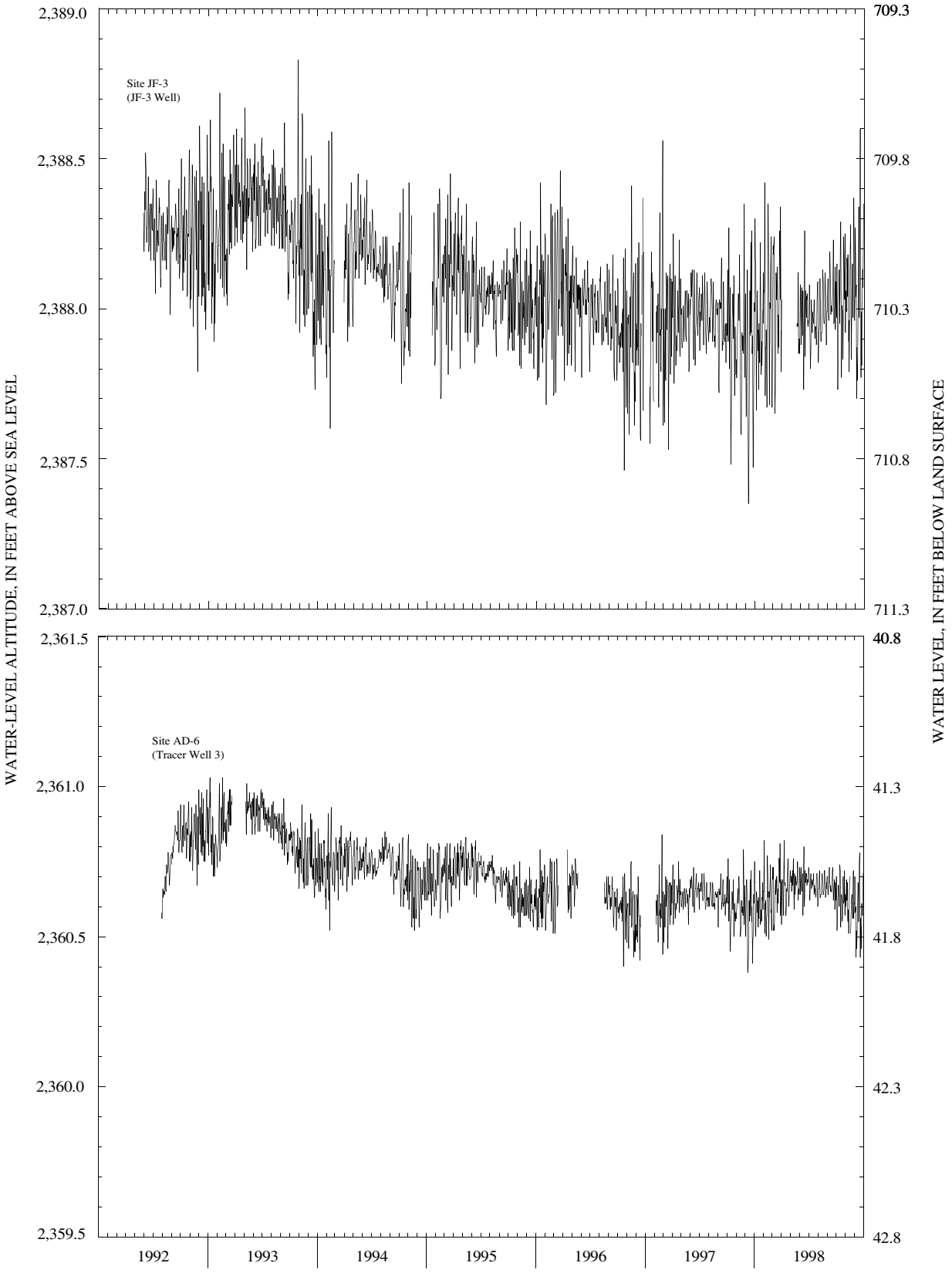

Figure 6. Daily average water levels in well JF-3, May 1992 through December 1998 and in well AD-6, July 1992 through December 1998

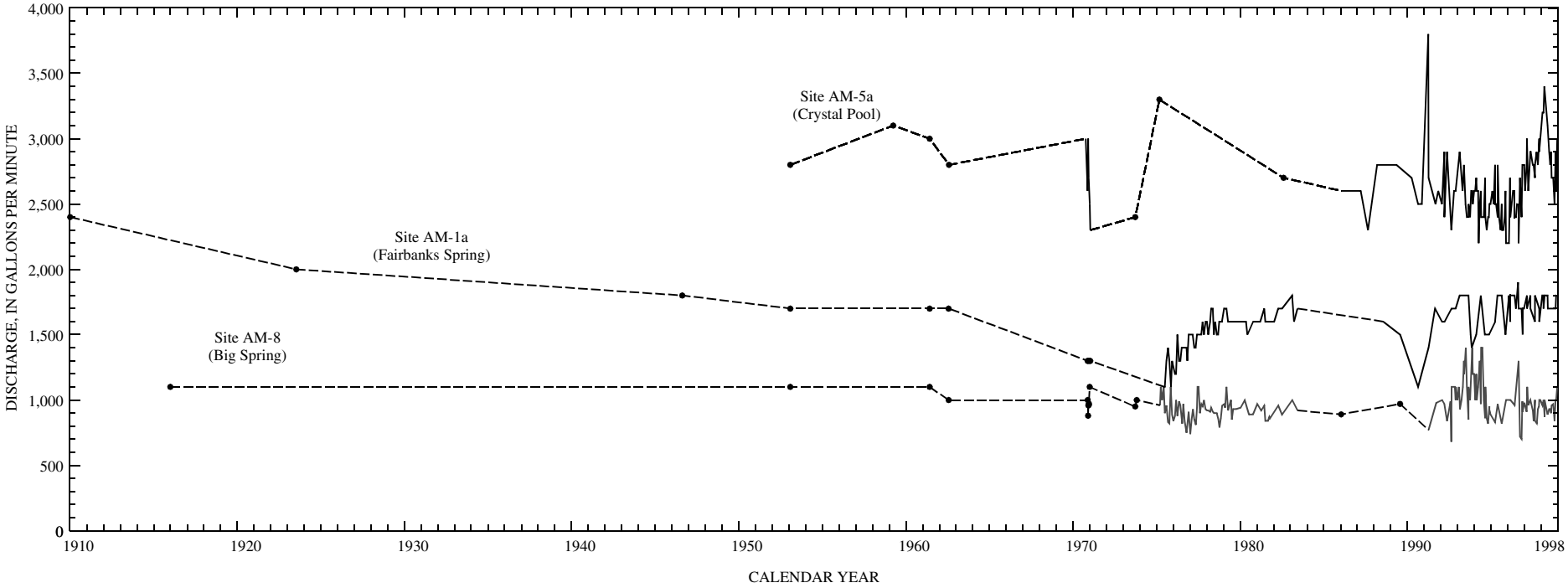

Figure 7. Discharge at sites AM-1a (Fairbanks Spring), AM-5a (Crystal Pool), and AM-8 (Big Spring) through 1998. Lines connect periodic measurements presented in this and previous reports on selected ground-water data for Yucca Mountain region. Solid lines connect yearly or more frequent measurements. Lines are dashed where measurements were not available for consecutive calendar years. A solid dot is a single isolated measurement.

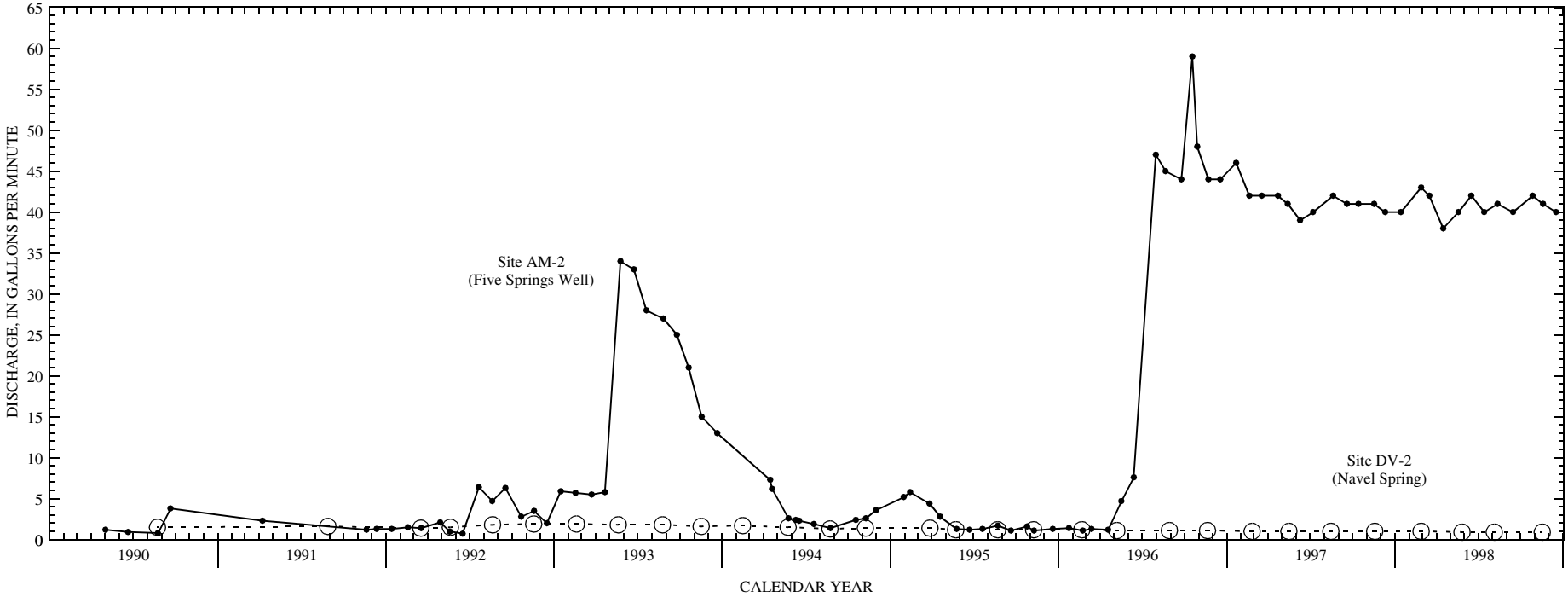

Figure 8. Discharge at sites AM-2 (Five Springs Well) and DV-2 (Navel Spring), 1990 through 1998. Symbols indicate periodic measurements presented in this and previous reports on selected ground-water data for Yucca Mountain region.

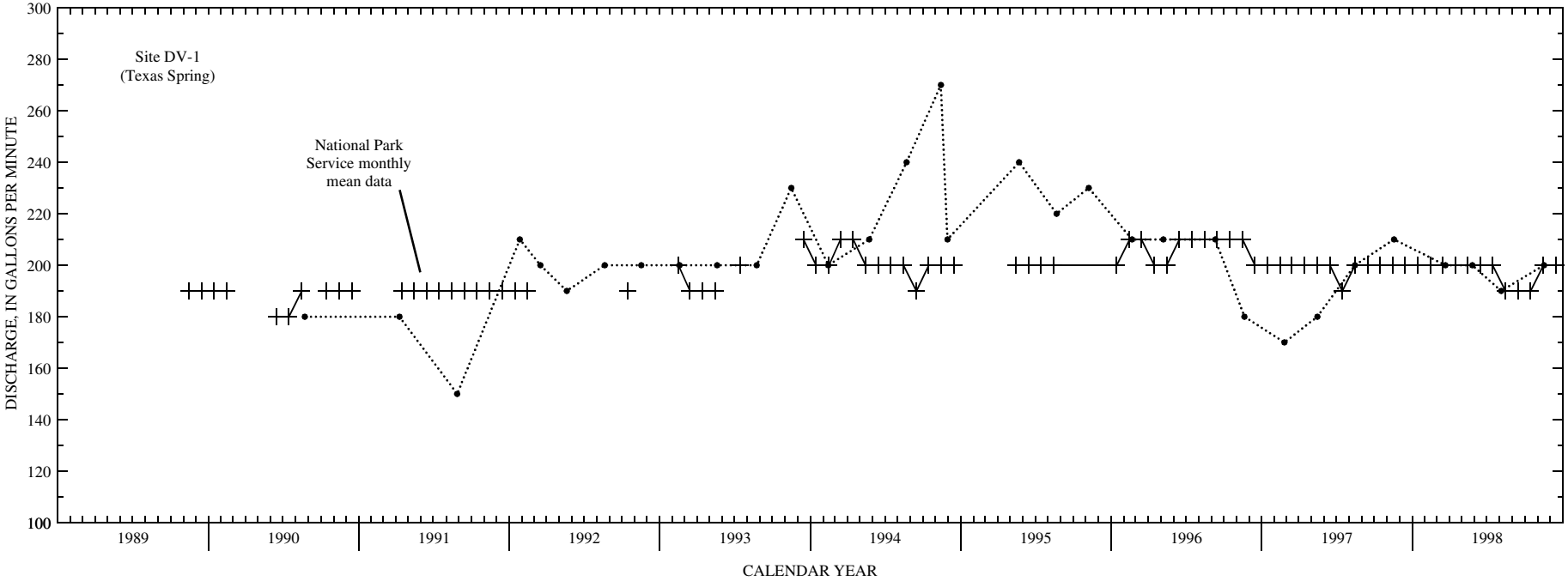

Figure 9. Discharge at site DV-1 (Texas Spring), 1989 through 1998. Dots indicate discrete USGS measurements presented in this and previous reports on selected ground-water data for Yucca Mountain region; periodic measurements for 1990-92 have been revised from those tabulated by La Camera and Westenburg (1994, table 5) to reflect previously unaccounted water at the site. Plus symbols represent National Park Service monthly mean data for any given month and are not connected by a line where that data are not available for consecutive months. Differences between periodic measurements and monthly means may be due to site-specific conditions that affect accuracy of the measurement methods used. Accuracy of periodic measurements is limited by unmeasurable flow near the walls of the flume, an unequal distribution of velocities in the limited width of the measurement section, and a large percentage of total flow contained in each measurable portion of flow.

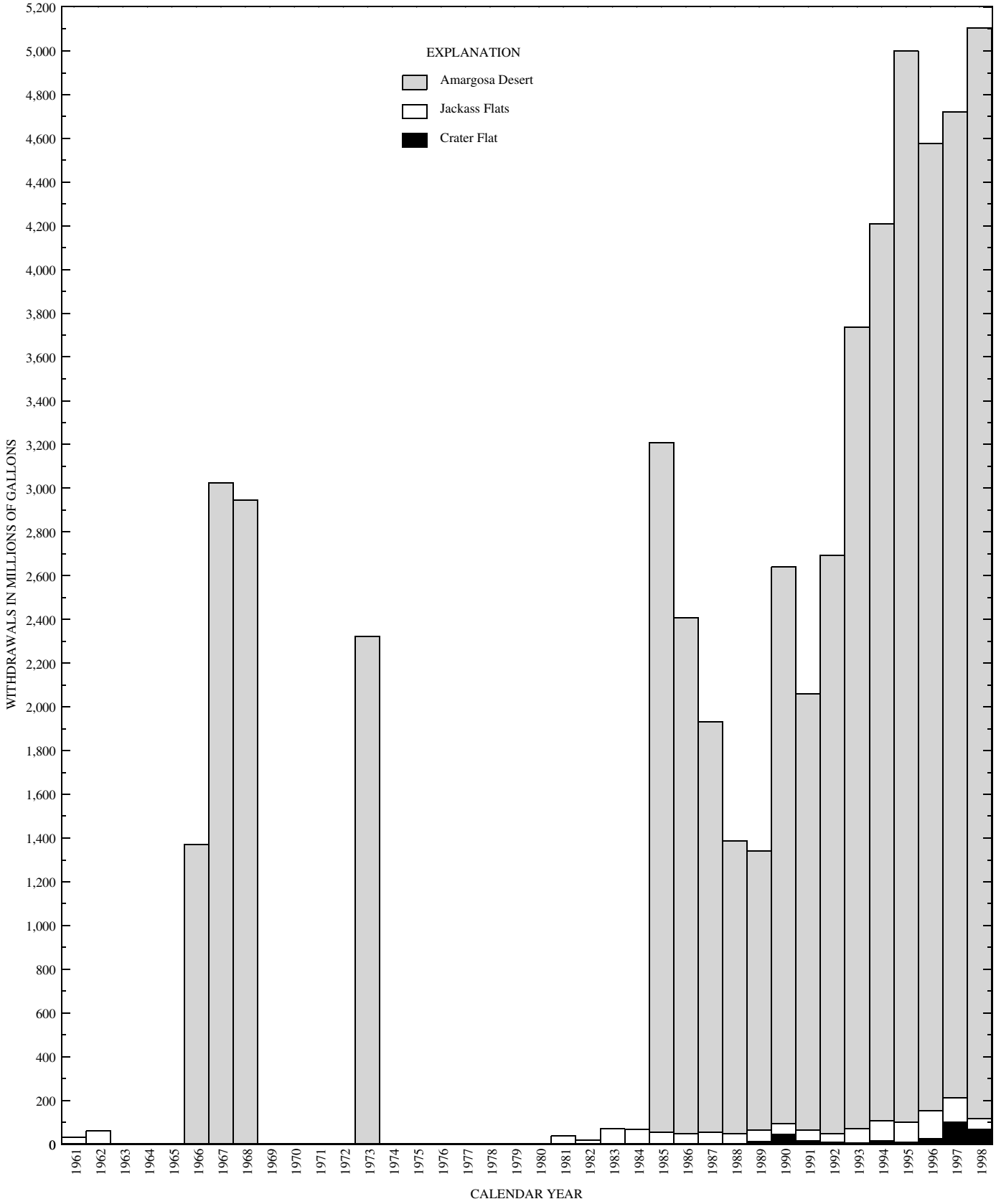

Figure 10. Available estimates of annual ground-water withdrawals for selected areas within Alkali Flat-Furnace Creek Ranch ground-water subbasin, 1961 through 1998. In each hydrographic area, ground water may have been withdrawn in years for which no estimates are available and no bars are shown. Total bar height equals the approximate sum of withdrawals from all areas within subbasin for given year.

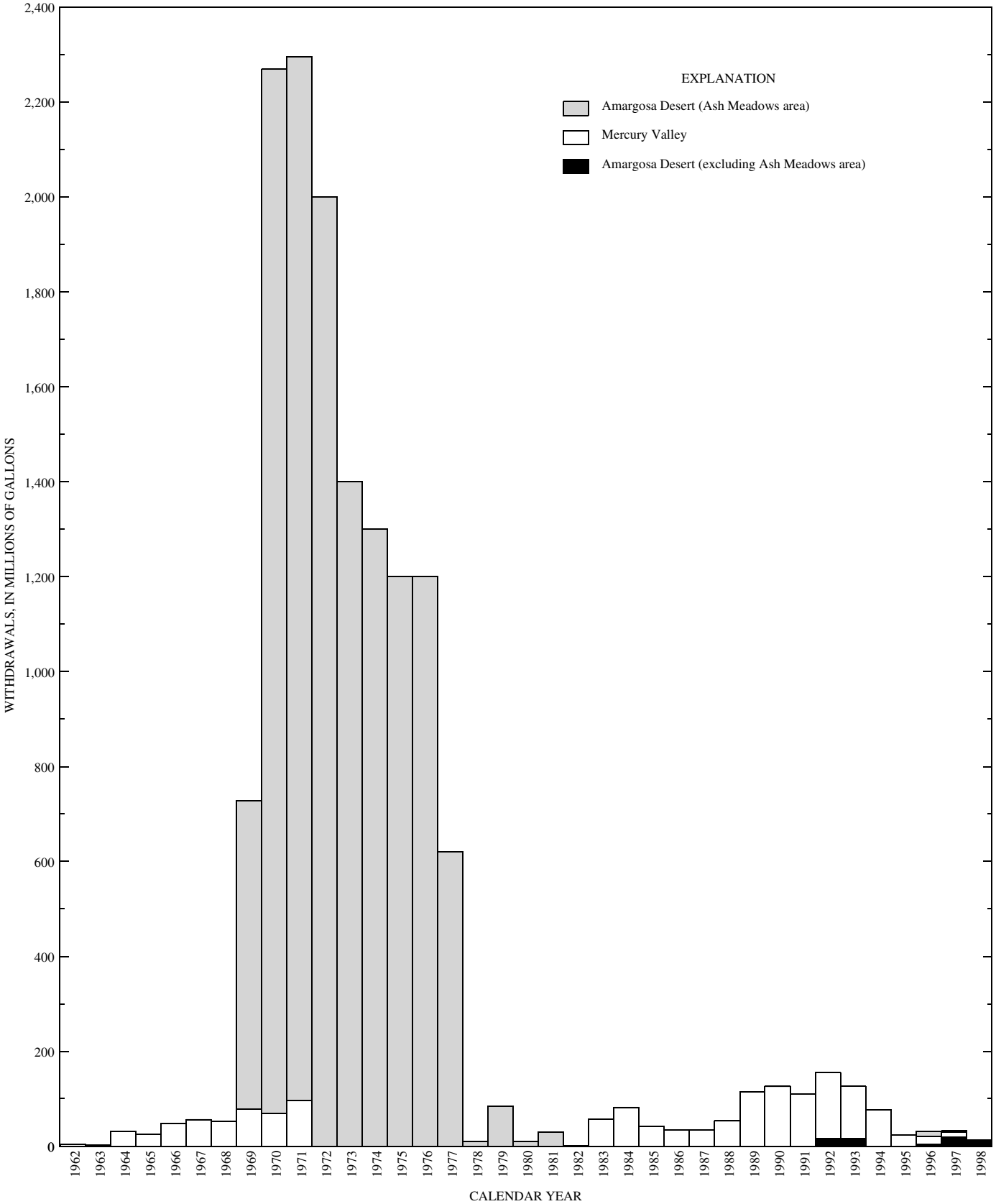

Figure 11. Available estimates of annual ground-water withdrawals for selected areas within Ash Meadows ground-water sub-basin, 1962 through 1998. In each hydrographic area, ground water may have been withdrawn in years for which no estimates are available and no bars are shown. Total bar height equals the approximate sum of withdrawals from all areas within sub-basin for given year.

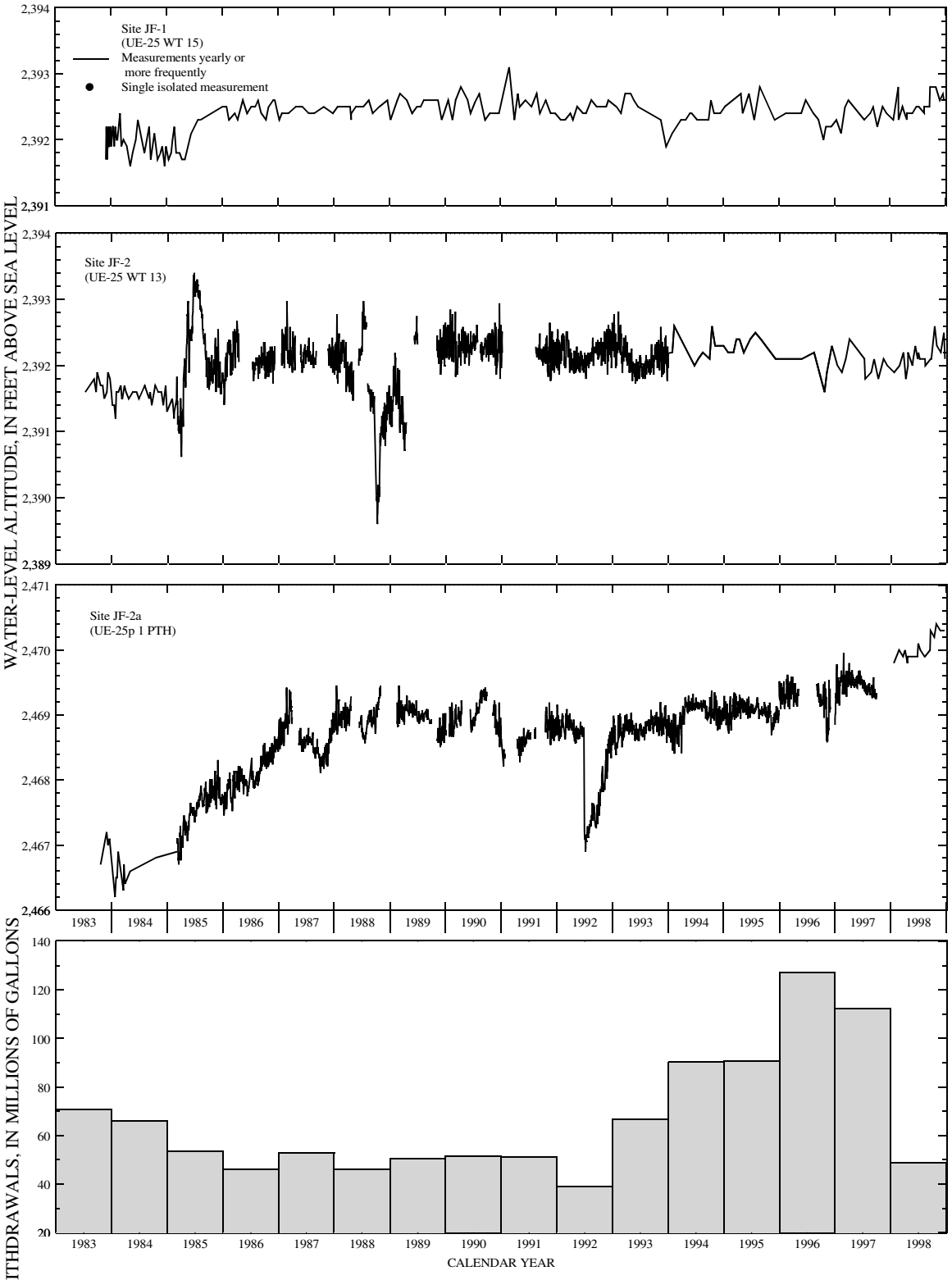

Figure 12. Water-level altitudes in wells JF-1, JF-2, JF-2a, J-13, J-11, J-12, and JF-3, and estimated annual ground-water withdrawals from Jackass Flats, 1983 through 1998. Lines connect periodic measurements or daily average water levels (when continual data recorded by instrumentation were available for more than half a year). Solid lines connect yearly or more frequent measurements. Lines are dashed where measurements were not available for consecutive calendar years. A solid dot is a single isolated measurement. Periodic measurements that may reflect short-term conditions at a site have been excluded (see section "Discussion of Ground-Water Levels and Ground-Water Withdrawals in Jackass Flats").

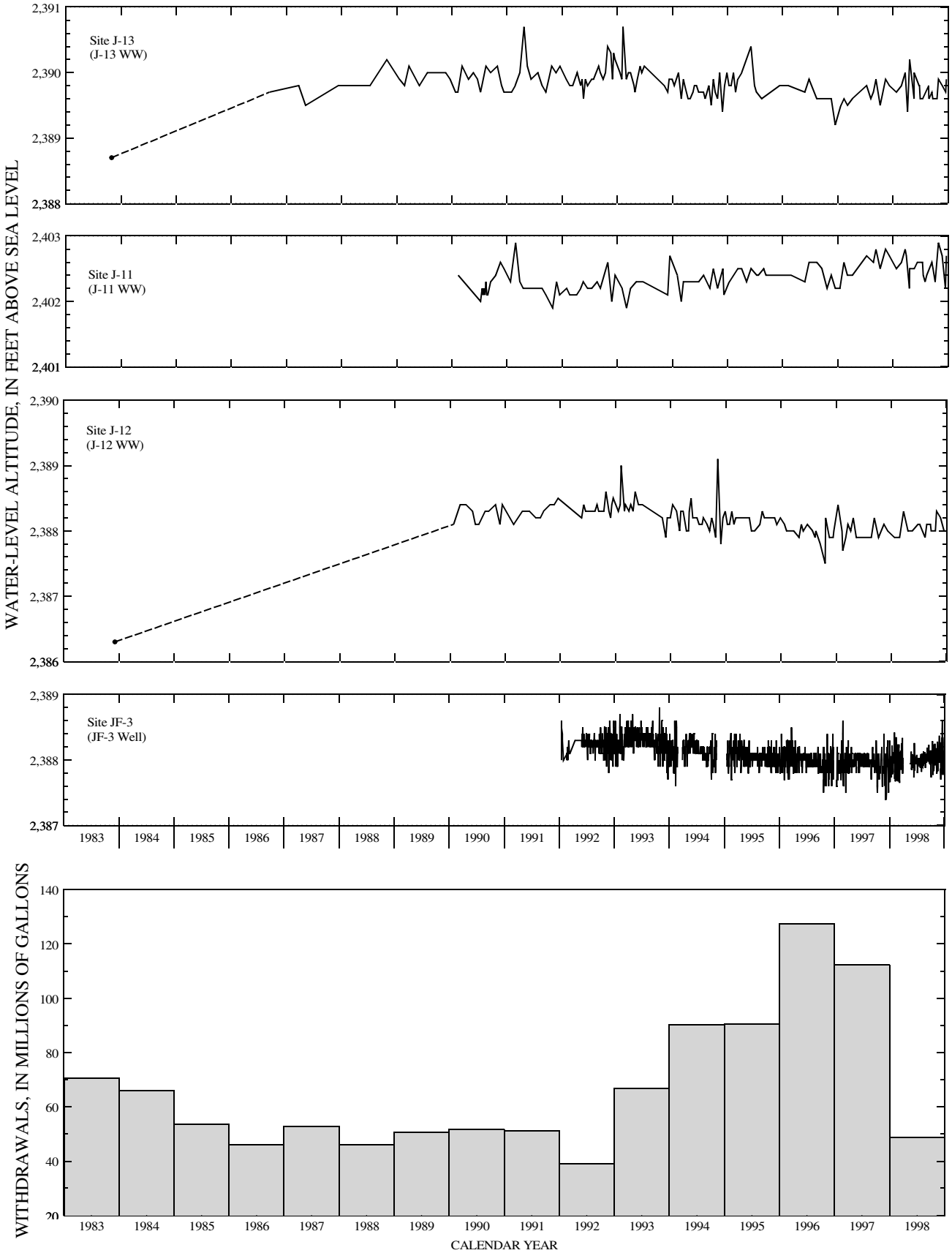

Figure 12. Continued.

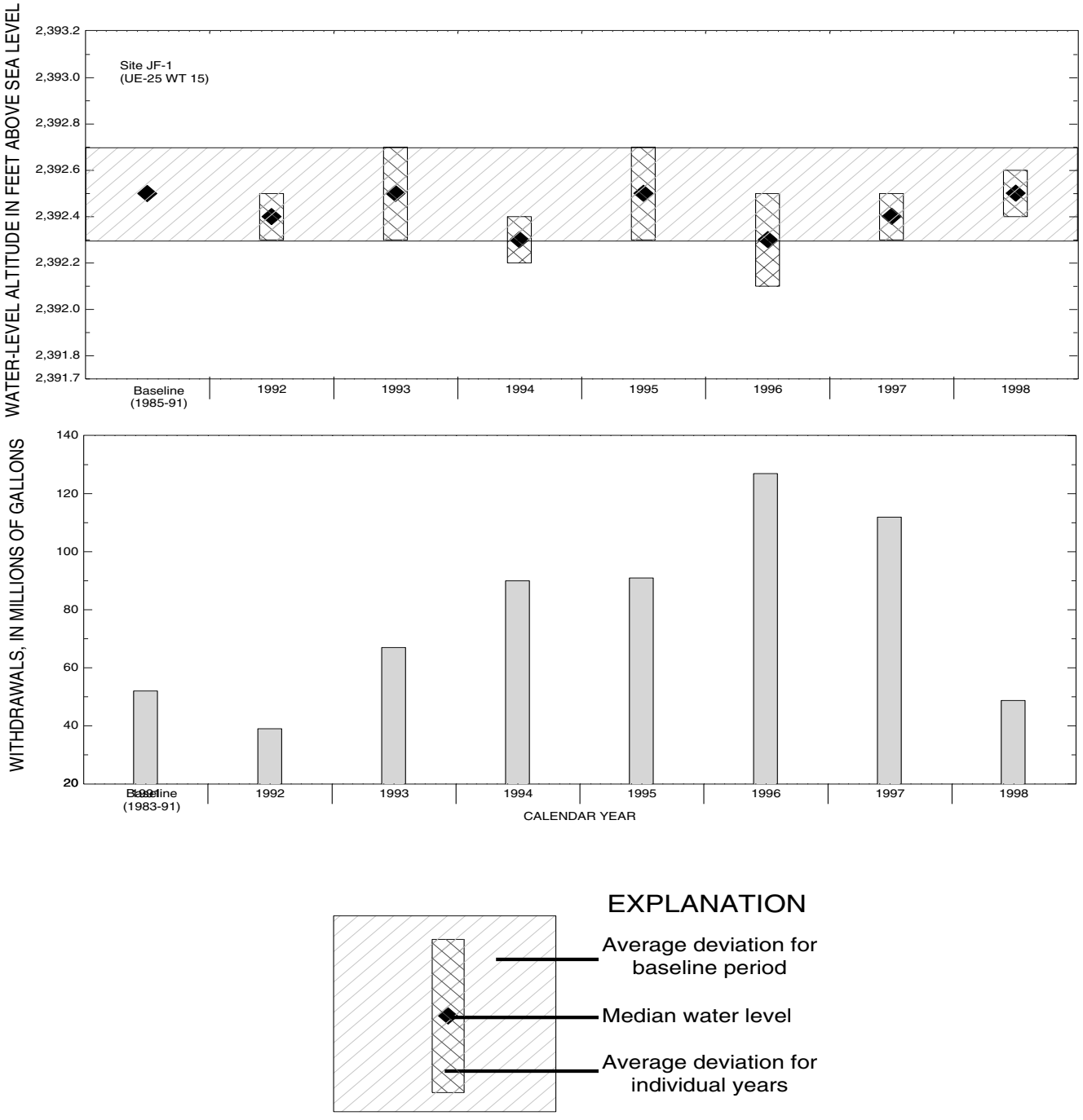

Figure 13. Median water-level altitudes and average deviation of water levels for wells JF-1, JF-2, JF-2a, J-13, J-11, J-12, and JF-3, and estimated annual ground-water withdrawals from Jackass Flats, for selected baseline periods and for calendar years 1992 through 1998. Statistical data for individual years included in baseline periods are not shown.

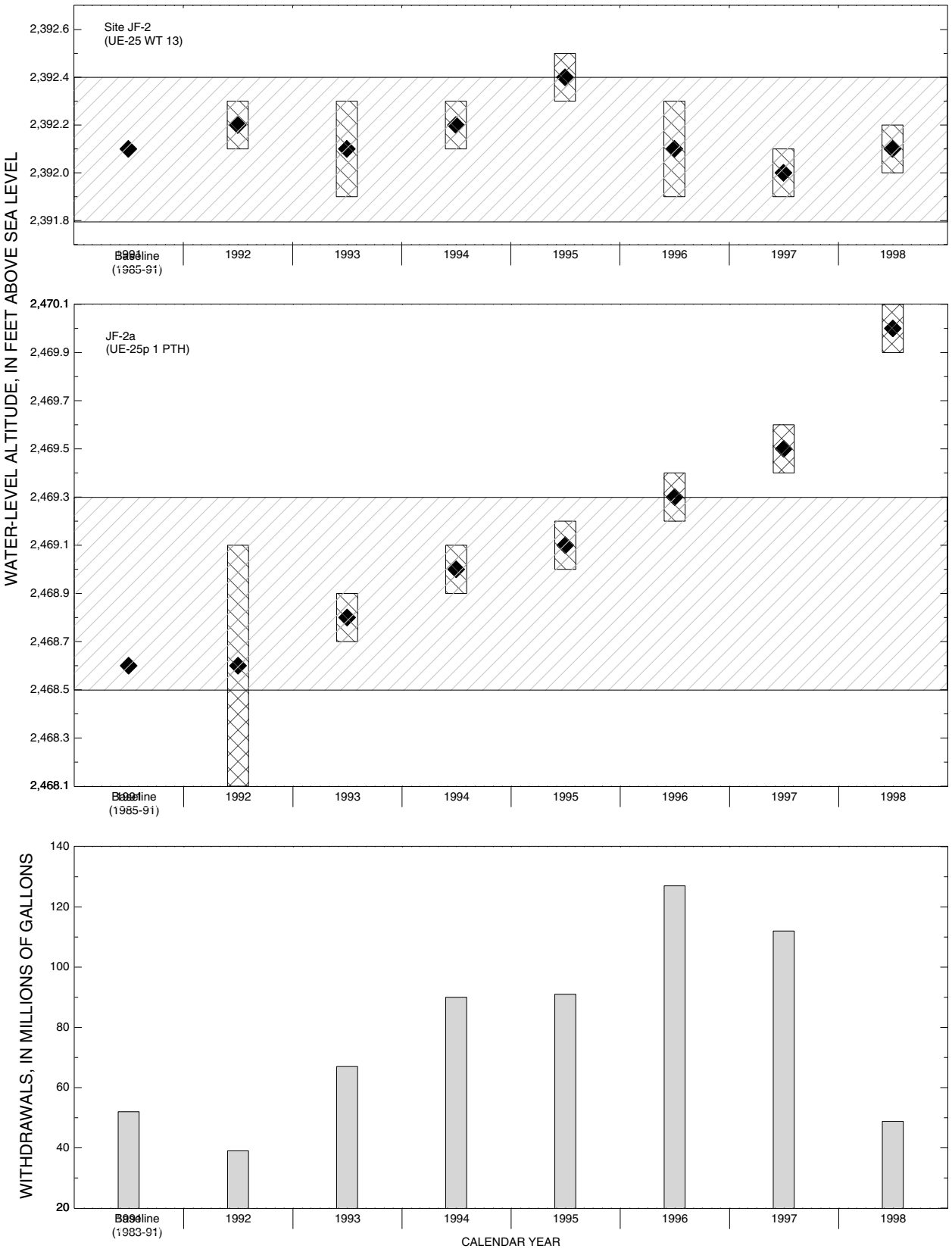

Figure 13. Continued.

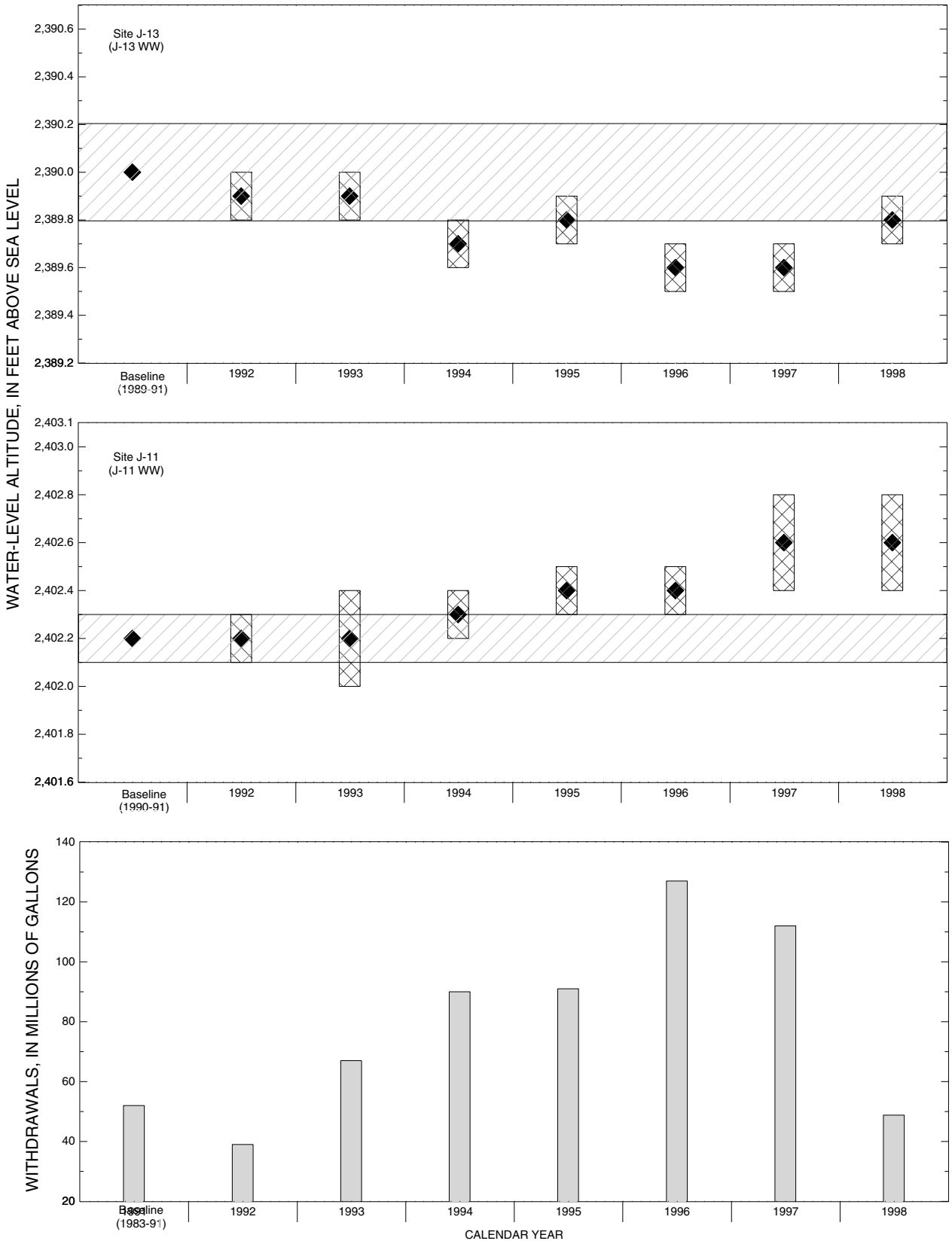

Figure 13. Continued.

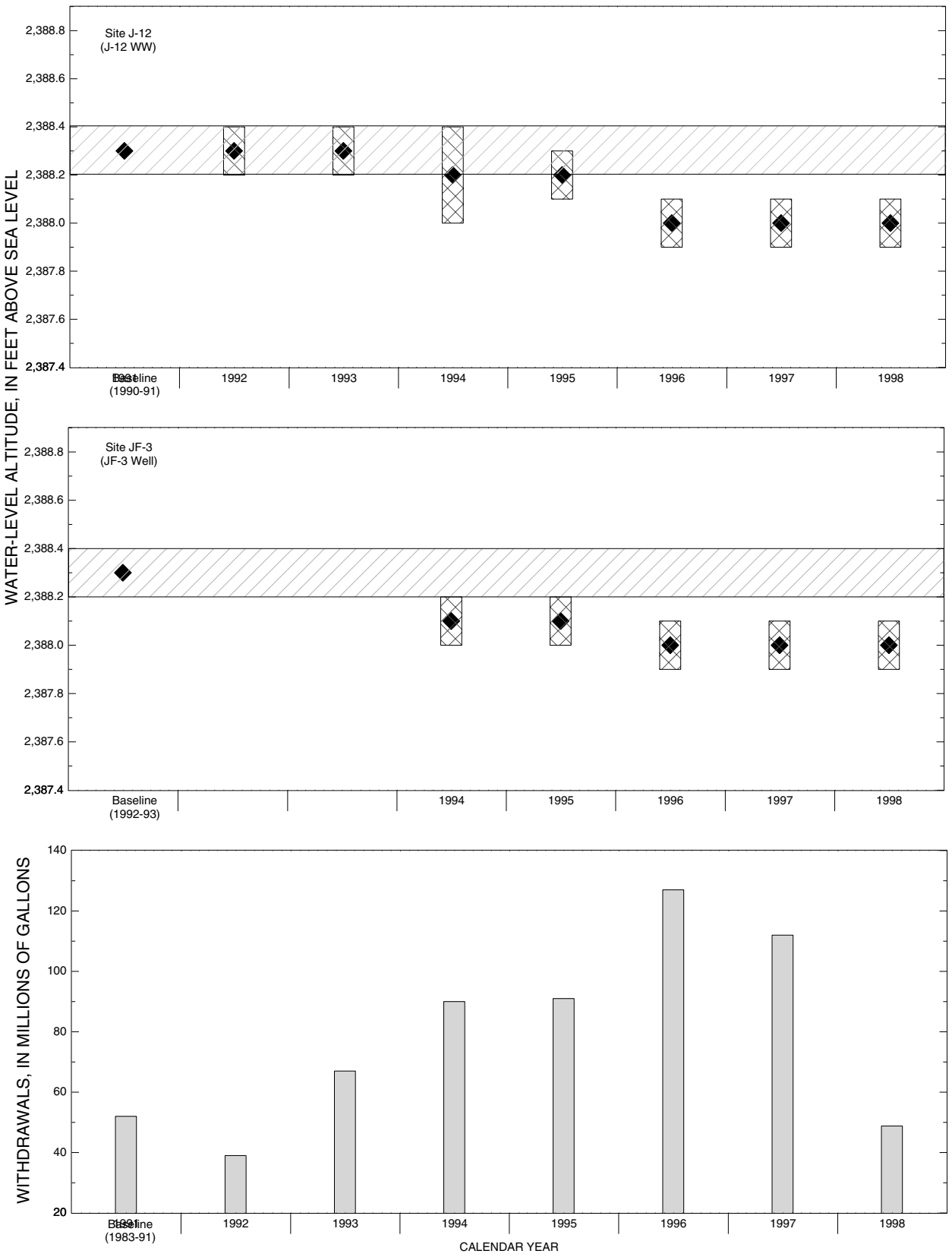

Figure 13. Continued.

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998

Site Number: Sites are grouped by hydrographic area and, within each area, are listed in general north-to-south, then west-to-east order. See text section "Site Number" for further discussion.

U.S. Geological Survey site identification: Unique identification number for site as stored in files and data bases of U.S. Geological Survey (USGS).

Land-surface altitude: Altitude of land surface in vicinity of site. Exception is altitude for site AM-4, which is altitude of bolt that serves as measurement point. Altitudes are reported to nearest 0.1 foot and were derived from USGS land surveys.

Height of measurement point: Height of measurement point (MP) most recently used. MP is stable, recoverable point from which periodic measurements to depth of water are made. MP at site AM-4 is bolt fastened to south wall of fissure, and is not referenced to land surface. Negative number indicates MP is below land surface.

Depth to water: Depths listed generally represent water level below land surface. An exception is site AM-4, where data represent water levels below measurement point. Apparent differences in depth to water at sites that list data from several sources may result from differing estimates of distance from land surface to measurement point used.

Method: Method used to measure depth to water. A, average monthly water level, reported for 15th of month (see text section titled "Other" under section "Periodic Water-Level Data" for further discussion); N, ruled tape; S, steel tape; T, electric tape; V, calibrated electric tape; W, calibrated wireline device; Z, measurement method unknown.

Site status: Known conditions at site that may have affected measured depth to water. F, flowing; P, pumping; Z, measurement made in pump-discharge column.

Data source: EMP, Environmental-Monitoring Program (USGS); NDWR, Nevada Division of Water Resources; NPS, National Park Service; NTS, Nevada Test Site USGS/Department of Energy Cooperative Program; PVT, private owner; SCP, Site-Characterization Project (USGS); USFWS, U.S. Fish and Wildlife Service; USGS-NV, other Nevada District Programs.

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
CF-1a	365445116383901	GEXA Well 3	4,080.9	1.68	01-15-98	0948	171.95	3,909.0	S	-	EMP
					02-18-98	1305	172.29	3,908.6	S	-	EMP
					03-18-98	0832	172.30	3,908.6	S	-	EMP
					04-14-98	0958	171.95	3,909.0	S	-	EMP
					05-28-98	0940	171.50	3,909.4	S	-	EMP
					06-17-98	1040	171.34	3,909.6	S	-	EMP
					07-08-98	1554	171.20	3,909.7	S	-	EMP
					08-11-98	1257	171.06	3,909.8	S	-	EMP
					09-15-98	1350	170.89	3,910.0	S	-	EMP
					10-27-98	0931	170.94	3,910.0	S	-	EMP
					11-24-98	1142	171.02	3,909.9	S	-	EMP
					12-16-98	1122	171.27	3,909.6	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
CF-2	364732116330701	USW VH-1	3,161.1	1.17	01-21-98	0946	604.33	2,556.8	S	-	SCP
					02-10-98	0822	604.30	2,556.8	S	-	SCP
					02-25-98	1030	603.95	2,557.2	S	-	NTS
					03-18-98	1028	603.92	2,557.2	V	-	EMP
					04-09-98	0925	603.76	2,557.3	S	-	SCP
					04-14-98	0830	603.73	2,557.4	V	-	EMP
					05-28-98	1105	603.74	2,557.4	V	-	EMP
					05-28-98	1342	603.68	2,557.4	S	-	SCP
					06-17-98	1205	603.79	2,557.3	V	-	EMP
					06-25-98	1313	603.64	2,557.5	S	-	SCP
					07-08-98	0853	603.66	2,557.4	S	-	SCP
					07-27-98	1200	603.61	2,557.5	S	-	SCP
					08-11-98	1023	603.67	2,557.4	V	-	EMP
					09-03-98	0848	603.58	2,557.5	S	-	SCP
					09-15-98	1225	603.65	2,557.4	V	-	EMP
					09-30-98	1252	603.62	2,557.5	S	-	SCP
					10-08-98	0937	603.61	2,557.5	S	-	SCP
					10-25-98	0745	603.75	2,557.4	V	-	EMP
					11-24-98	1025	603.71	2,557.4	V	-	EMP
					12-15-98	1358	603.74	2,557.4	S	-	SCP
					12-16-98	1213	603.77	2,557.3	V	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
CF-3	364105116302601	Cind-R-Lite Well	2,725.6	-3.20	01-15-98	0815	331.30	2,394.3	S	-	EMP
					02-20-98	0955	331.57	2,394.0	S	-	EMP
					03-18-98	1255	331.02	2,394.6	S	-	EMP
					04-14-98	1222	331.32	2,394.3	S	-	EMP
					05-28-98	0808	331.34	2,394.3	S	-	EMP
					06-18-98	1200	331.35	2,394.2	S	-	EMP
					07-15-98	0855	331.43	2,394.2	S	-	EMP
					08-20-98	0810	331.48	2,394.1	S	-	EMP
					09-16-98	0920	331.36	2,394.2	S	-	EMP
					10-28-98	1030	331.38	2,394.2	S	-	EMP
					11-18-98	1409	331.42	2,394.2	S	-	EMP
					12-16-98	1453	331.52	2,394.1	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
JF-1	365116116233801	UE-25 WT 15	3,553.8	.18	01-22-98	1136	1,161.53	2,392.3	S	-	SCP
					01-22-98	1342	1,161.54	2,392.3	S	-	SCP
					02-24-98	1511	1,161.01	2,392.8	S	-	SCP
					02-26-98	1427	1,161.53	2,392.3	V	-	EMP
					03-24-98	1041	1,161.31	2,392.5	V	-	EMP
					04-07-98	1535	1,161.41	2,392.4	S	-	SCP
					04-22-98	1150	1,161.46	2,392.3	V	-	EMP
					04-22-98	1306	1,161.38	2,392.4	S	-	SCP
					05-21-98	1148	1,161.42	2,392.4	V	-	EMP
					05-27-98	1048	1,161.37	2,392.4	S	-	SCP
					06-22-98	1316	1,161.28	2,392.5	S	-	SCP
					06-26-98	1353	1,161.29	2,392.5	V	-	EMP
					07-09-98	0938	1,161.31	2,392.5	S	-	SCP
					08-13-98	0914	1,161.40	2,392.4	V	-	EMP
					08-13-98	1218	1,161.31	2,392.5	S	-	SCP
					09-17-98	1140	1,161.28	2,392.5	V	-	EMP
					09-21-98	1455	1,161.05	2,392.8	S	-	SCP
					10-15-98	0836	1,160.99	2,392.8	S	-	SCP
					10-29-98	1114	1,161.03	2,392.8	V	-	EMP
					11-23-98	1248	1,161.17	2,392.6	V	-	EMP
					12-14-98	1052	1,161.09	2,392.7	S	-	SCP
					12-22-98	1148	1,161.17	2,392.6	V	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
JF-2	364945116235001	UE-25 WT 13	3,387.5	1.00	01-22-98	1046	995.61	2,391.9	S	-	SCP
					02-26-98	1400	995.51	2,392.0	V	-	EMP
					03-24-98	1017	995.31	2,392.2	V	-	EMP
					04-08-98	1046	995.69	2,391.8	S	-	SCP
					04-22-98	1111	995.50	2,392.0	V	-	EMP
					04-23-98	1036	995.32	2,392.2	S	-	SCP
					05-21-98	1119	995.48	2,392.0	V	-	EMP
					05-27-98	1332	995.39	2,392.1	S	-	SCP
					06-10-98	1053	995.25	2,392.2	S	-	SCP
					06-26-98	1314	995.44	2,392.1	V	-	EMP
					07-01-98	1058	995.27	2,392.2	S	-	SCP
					07-09-98	0848	995.44	2,392.1	S	-	SCP
					08-12-98	1148	995.41	2,392.1	S	-	SCP
					08-13-98	0842	995.53	2,392.0	V	-	EMP
					09-17-98	1058	995.41	2,392.1	V	-	EMP
					09-22-98	1442	995.38	2,392.1	S	-	SCP
					10-15-98	1153	994.89	2,392.6	S	-	SCP
					10-29-98	1040	995.20	2,392.3	V	-	EMP
					11-23-98	1215	995.34	2,392.2	V	-	EMP
					12-14-98	1146	994.99	2,392.5	S	-	SCP
					12-22-98	1120	995.38	2,392.1	V	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
JF-2a	364938116252102	UE-25p 1 PTH	3,655.5	.56	01-23-98	1207	1,185.70	2,469.8	V	-	EMP
					02-26-98	1456	1,185.50	2,470.0	V	-	EMP
					03-24-98	1108	1,185.55	2,470.0	V	-	EMP
					04-07-98	1434	1,185.53	2,470.0	S	-	SCP
					04-22-98	1215	1,185.71	2,469.8	V	-	EMP
					04-23-98	1138	1,185.60	2,469.9	S	-	SCP
					05-21-98	1239	1,185.62	2,469.9	V	-	EMP
					05-27-98	1136	1,185.62	2,469.9	S	-	SCP
					06-10-98	1346	1,185.61	2,469.9	S	-	SCP
					06-26-98	1437	1,185.62	2,469.9	V	-	EMP
					07-01-98	1139	1,185.41	2,470.1	S	-	SCP
					07-16-98	1035	1,185.53	2,470.0	V	-	EMP
					08-12-98	1110	1,185.55	2,470.0	S	-	SCP
					08-13-98	0947	1,185.60	2,469.9	V	-	EMP
					09-17-98	1214	1,185.54	2,470.0	V	-	EMP
					09-21-98	1552	1,185.21	2,470.3	S	-	SCP
					10-15-98	1057	1,185.27	2,470.2	S	-	SCP
					10-29-98	1155	1,185.13	2,470.4	V	-	EMP
					11-23-98	1325	1,185.22	2,470.3	V	-	EMP
					12-22-98	1223	1,185.25	2,470.2	V	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
J-13	364828116234001	J-13 WW	3,317.9	1.11	01-23-98	1240	928.16	2,389.7	V	-	EMP
					02-26-98	1315	928.05	2,389.8	V	-	EMP
					03-24-98	0950	927.94	2,390.0	V	-	EMP
					04-08-98	0844	928.47	2,389.4	S	-	SCP
					04-22-98	0940	927.70	2,390.2	V	-	EMP
					05-21-98	0742	928.25	2,389.6	S	-	SCP
					05-21-98	1055	927.87	2,390.0	V	-	EMP
					06-23-98	0742	928.13	2,389.8	S	-	SCP
					06-26-98	1649	928.08	2,389.8	V	-	EMP
					07-01-98	0748	928.25	2,389.6	S	-	SCP
					07-16-98	1109	928.29	2,389.6	V	-	EMP
					08-25-98	0818	928.11	2,389.8	S	-	SCP
					08-27-98	1023	928.25	2,389.6	V	-	EMP
					09-17-98	1302	928.19	2,389.7	V	-	EMP
					09-23-98	0812	928.31	2,389.6	S	-	SCP
					10-20-98	0804	928.30	2,389.6	S	-	SCP
					10-29-98	1325	927.96	2,389.9	V	-	EMP
					11-23-98	1146	928.11	2,389.8	V	-	EMP
					12-17-98	0817	928.22	2,389.7	S	-	SCP
					12-22-98	1055	928.04	2,389.9	V	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
J-11	364706116170601	J-11 WW	3,442.8	2.11	01-23-98	1031	1,040.29	2,402.5	V	-	EMP
					02-26-98	1242	1,040.15	2,402.6	V	-	EMP
					03-24-98	0912	1,040.05	2,402.8	V	-	EMP
					03-31-98	1306	1,040.08	2,402.7	W	-	SCP
					04-21-98	1152	1,040.56	2,402.2	W	-	SCP
					04-22-98	0905	1,040.28	2,402.5	V	-	EMP
					05-21-98	0923	1,040.29	2,402.5	V	-	EMP
					06-10-98	1449	1,040.23	2,402.6	S	-	SCP
					06-26-98	1225	1,040.23	2,402.6	V	-	EMP
					07-16-98	0950	1,040.25	2,402.6	V	-	EMP
					07-21-98	1033	1,040.38	2,402.4	S	-	SCP
					08-03-98	1001	1,040.49	2,402.3	S	-	SCP
					08-13-98	0715	1,040.38	2,402.4	V	-	EMP
					09-17-98	0950	1,040.25	2,402.6	V	-	EMP
					09-24-98	1054	1,040.33	2,402.5	S	-	SCP
					10-07-98	0910	1,040.47	2,402.3	S	-	SCP
					10-29-98	1359	1,039.91	2,402.9	V	-	EMP
					11-23-98	1420	1,040.11	2,402.7	V	-	EMP
					12-16-98	1022	1,040.61	2,402.2	S	-	SCP
					12-22-98	1305	1,040.13	2,402.7	V	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
J-12	364554116232401	J-12 WW	3,128.4	3.95	01-22-98	1003	740.53	2,387.9	S	-	SCP
					02-26-98	1020	740.53	2,387.9	S	-	NTS
					03-24-98	1242	740.11	2,388.3	V	-	EMP
					04-22-98	1045	740.35	2,388.0	V	-	EMP
					05-21-98	1035	740.44	2,388.0	V	-	EMP
					06-26-98	1533	740.33	2,388.1	V	-	EMP
					07-01-98	0834	740.31	2,388.1	S	-	SCP
					07-09-98	1145	740.26	2,388.1	S	-	SCP
					08-13-98	0815	740.48	2,387.9	V	-	EMP
					08-25-98	0856	740.29	2,388.1	S	-	SCP
					09-17-98	1245	740.29	2,388.1	V	-	EMP
					09-23-98	0857	740.42	2,388.0	S	-	SCP
					10-20-98	0844	740.36	2,388.0	S	-	SCP
					10-29-98	1242	740.06	2,388.3	V	-	EMP
					11-23-98	1046	740.22	2,388.2	V	-	EMP
					12-16-98	1340	740.38	2,388.0	S	-	SCP
					12-22-98	1002	740.39	2,388.0	V	-	EMP
JF-3	364528116232201	JF-3 Well	3,098.3	2.27	01-23-98	1317	710.45	2,387.8	V	-	EMP
					02-26-98	1201	710.44	2,387.9	V	-	EMP
					03-24-98	1201	710.09	2,388.2	V	-	EMP
					04-22-98	1001	710.32	2,388.0	V	-	EMP
					05-21-98	1001	710.43	2,387.9	V	-	EMP
					06-26-98	1601	710.32	2,388.0	V	-	EMP
					07-23-98	0946	710.41	2,387.9	V	-	EMP
					08-27-98	0931	710.47	2,387.8	V	-	EMP
					09-17-98	1031	710.32	2,388.0	V	-	EMP
					10-29-98	1001	710.07	2,388.2	V	-	EMP
					11-23-98	1101	710.19	2,388.1	V	-	EMP
					12-22-98	1016	710.35	2,388.0	V	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
RV-1	363815116175901	TW-5	3,056.0	1.6	01-26-98	1150	677.37	2,378.6	V	-	EMP
					02-19-98	1334	677.28	2,378.7	V	-	EMP
					03-18-98	1408	677.27	2,378.7	V	-	EMP
					04-14-98	1430	677.25	2,378.8	V	-	EMP
					05-20-98	0820	677.22	2,378.8	V	-	EMP
					06-18-98	1408	677.12	2,378.9	V	-	EMP
					07-15-98	1210	677.10	2,378.9	V	-	EMP
					08-12-98	1345	677.12	2,378.9	V	-	EMP
					09-16-98	1250	677.12	2,378.9	V	-	EMP
					10-28-98	1235	677.11	2,378.9	V	-	EMP
					11-25-98	1005	677.10	2,378.9	V	-	EMP
					12-18-98	0920	677.09	2,378.9	V	-	EMP
MV-1	363530116021401	Army 1 WW	3,153.3	3.10	01-26-98	1335	785.32	2,368.0	V	Z	EMP
					02-19-98	1125	785.42	2,367.9	V	Z	EMP
					03-19-98	0745	785.23	2,368.1	V	Z	EMP
					04-16-98	0826	785.32	2,368.0	V	Z	EMP
					05-21-98	0805	785.17	2,368.1	V	Z	EMP
					06-29-98	0905	785.15	2,368.2	V	Z	EMP
					07-16-98	0835	785.14	2,368.2	V	Z	EMP
					08-27-98	0757	785.16	2,368.1	V	Z	EMP
					09-17-98	0840	785.12	2,368.2	V	Z	EMP
					10-29-98	0815	784.91	2,368.4	V	Z	EMP
					11-25-98	0820	785.24	2,368.1	V	Z	EMP
					12-22-98	0843	785.08	2,368.2	V	Z	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-1	364141116351401	NA-6 Well BGMW-10	2,627.9	1.7	01-15-98	1127	269.47	2,358.4	S	-	EMP
					02-18-98	1442	269.83	2,358.1	S	-	EMP
					03-18-98	1150	269.77	2,358.1	S	-	EMP
					03-25-98	--	269.6	2,358.3	Z	-	PVT
					04-14-98	1120	269.65	2,358.2	S	-	EMP
					05-28-98	1238	269.61	2,358.3	S	-	EMP
					06-17-98	1324	269.76	2,358.1	S	-	EMP
					06-24-98	--	269.8	2,358.1	Z	-	PVT
					07-15-98	0955	269.63	2,358.3	S	-	EMP
					08-11-98	1128	269.63	2,358.3	S	-	EMP
					09-16-98	1020	269.61	2,358.3	S	-	EMP
					09-25-98	--	269.7	2,358.2	Z	-	PVT
					10-15-98	0928	269.49	2,358.4	S	-	EMP
					11-24-98	1255	269.58	2,358.3	S	-	EMP
					12-02-98	--	269.8	2,358.1	Z	-	PVT
					12-16-98	1345	269.61	2,358.3	S	-	EMP
AD-2	363830116241401	Airport Well	2,638.8	1.05	01-26-98	1220	324.95	2,313.8	V	-	EMP
					02-20-98	0934	324.89	2,313.9	V	-	EMP
					03-18-98	1326	325.18	2,313.6	V	-	EMP
					04-14-98	1310	325.07	2,313.7	V	-	EMP
					05-28-98	0740	325.12	2,313.7	V	-	EMP
					06-18-98	1255	325.13	2,313.7	V	-	EMP
					07-16-98	1342	325.13	2,313.7	V	-	EMP
					08-31-98	1258	325.01	2,313.8	V	P	EMP
					09-16-98	1120	325.08	2,313.7	V	-	EMP
					10-28-98	1110	325.11	2,313.7	V	-	EMP
					11-18-98	1448	325.11	2,313.7	V	-	EMP
					12-17-98	1510	325.13	2,313.7	V	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-2a	363835116234001	NDOT Well	2,656.8	.4	01-15-98	1315	342.44	2,314.4	S	-	EMP
					02-20-98	0915	341.85	2,315.0	S	-	EMP
					03-18-98	0655	342.13	2,314.7	S	-	EMP
					04-14-98	1350	343.13	2,313.7	S	-	EMP
					05-20-98	0800	343.11	2,313.7	S	-	EMP
					07-16-98	0740	343.51	2,313.3	S	-	EMP
					08-20-98	0720	342.46	2,314.3	S	-	EMP
					09-16-98	1145	343.18	2,313.6	S	-	EMP
					10-28-98	1140	343.32	2,313.5	S	-	EMP
					11-18-98	1330	343.04	2,313.8	S	-	EMP
					12-17-98	1450	342.61	2,314.2	V	-	EMP
AD-3a	363521116352501	Davidson Well	2,395.3	1.00	01-26-98	1500	131.69	2,263.6	S	-	EMP
					02-19-98	1524	131.58	2,263.7	S	-	EMP
					03-17-98	1448	131.49	2,263.8	S	-	EMP
					04-17-98	0918	131.62	2,263.7	S	-	EMP
					05-19-98	1320	131.71	2,263.6	S	-	EMP
					06-16-98	1445	131.83	2,263.5	S	-	EMP
					07-14-98	1412	132.14	2,263.2	S	-	EMP
					08-06-98	1218	132.26	2,263.0	S	-	EMP
					09-14-98	1315	132.32	2,263.0	S	-	EMP
					10-13-98	1310	132.35	2,263.0	S	-	EMP
					11-19-98	1210	132.42	2,262.9	S	-	EMP
					12-17-98	1305	132.19	2,263.1	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-4a	363428116234701	Cooks East Well	2,477.8	1.0	01-26-98	1420	119.36	2,358.4	S	-	EMP
					02-19-98	1450	119.47	2,358.3	S	-	EMP
					03-17-98	1517	119.34	2,358.5	S	-	EMP
					04-17-98	1000	119.65	2,358.2	S	-	EMP
					05-19-98	1240	119.52	2,358.3	S	-	EMP
					06-19-98	1520	119.38	2,358.4	S	-	EMP
					07-14-98	1335	119.67	2,358.1	S	-	EMP
					08-06-98	1145	119.66	2,358.1	S	-	EMP
					09-14-98	1245	119.68	2,358.1	S	-	EMP
					10-27-98	1232	119.64	2,358.2	S	-	EMP
					11-19-98	1248	119.72	2,358.1	S	-	EMP
					12-17-98	1344	119.58	2,358.2	S	-	EMP
AD-5	363310116294001	USBLM Well	2,376.4	.0	01-21-98	1201	126.90	2,249.5	S	-	EMP
					02-19-98	1604	126.53	2,249.9	S	-	EMP
					03-17-98	1425	126.22	2,250.2	S	-	EMP
					04-17-98	0845	126.94	2,249.5	S	-	EMP
					05-19-98	1417	127.73	2,248.7	S	-	EMP
					06-16-98	1420	127.88	2,248.5	S	-	EMP
					07-08-98	1331	128.16	2,248.2	S	-	EMP
					08-06-98	1250	128.54	2,247.9	S	-	EMP
					09-14-98	1343	129.01	2,247.4	S	-	EMP
					10-27-98	1315	129.32	2,247.1	S	-	EMP
					11-19-98	1140	129.28	2,247.1	S	-	EMP
					12-17-98	1235	129.13	2,247.3	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-6	363213116133800	Tracer Well 3	2,402.3	.4	01-12-98	0900	41.69	2,360.6	S	-	EMP
					03-19-98	0815	41.72	2,360.6	S	-	EMP
					04-16-98	0916	41.73	2,360.6	S	-	EMP
					05-20-98	0916	41.65	2,360.6	S	-	EMP
					06-18-98	1031	41.73	2,360.6	S	-	EMP
					07-23-98	1131	41.73	2,360.6	S	-	EMP
					08-31-98	1146	41.66	2,360.6	S	-	EMP
					09-17-98	0801	41.67	2,360.6	S	-	EMP
					10-30-98	0716	41.67	2,360.6	S	-	EMP
					11-24-98	0746	41.66	2,360.6	S	-	EMP
					12-18-98	0746	41.54	2,360.8	S	-	EMP
AD-7a	363009116302702	Blackman Well	2,305.0	.78	01-26-98	1537	68.72	2,236.3	S	-	EMP
					02-19-98	0946	68.46	2,236.5	S	-	EMP
					03-17-98	1404	68.20	2,236.8	S	-	EMP
					03-24-98	--	68.10	2,236.9	T	-	NDWR
					04-17-98	0820	68.07	2,236.9	S	-	EMP
					05-19-98	1444	69.10	2,235.9	S	-	EMP
					06-16-98	1353	71.24	2,233.8	S	-	EMP
					07-14-98	1442	72.08	2,232.9	S	-	EMP
					08-06-98	1323	72.19	2,232.8	S	-	EMP
					09-14-98	1405	71.18	2,233.8	S	-	EMP
					10-27-98	--	70.78	2,234.2	T	-	NDWR
					10-27-98	1340	70.82	2,234.2	S	-	EMP
					11-19-98	1120	70.39	2,234.6	S	-	EMP
					12-17-98	1208	69.89	2,235.1	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-8	362929116085701	Cherry Patch Well	2,394.3	.6	01-26-98	1055	35.20	2,359.1	S	-	EMP
					02-20-98	0732	35.02	2,359.3	S	-	EMP
					03-19-98	0644	35.13	2,359.2	S	-	EMP
					04-16-98	0710	35.11	2,359.2	S	-	EMP
					05-21-98	1440	35.11	2,359.2	S	-	EMP
					06-18-98	0700	34.72	2,359.6	S	-	EMP
					07-16-98	0640	35.30	2,359.0	S	-	EMP
					08-20-98	0637	33.96	2,360.3	S	-	EMP
					09-18-98	0730	37.18	2,357.1	S	P	EMP
					10-13-98	0941	35.27	2,359.0	S	-	EMP
					11-25-98	0635	35.22	2,359.1	S	-	EMP
					12-18-98	0645	44.05	2,350.2	S	P	EMP
AD-9	362848116264201	Gilgans North Well	2,264.8	-.10	01-26-98	1602	80.35	2,184.4	S	-	EMP
					02-19-98	0925	78.05	2,186.8	S	-	EMP
					03-17-98	1340	78.41	2,186.4	S	-	EMP
					03-24-98	--	79.50	2,185.3	S	-	NDWR
					04-17-98	0802	79.89	2,184.9	S	-	EMP
					05-19-98	1513	85.36	2,179.4	S	-	EMP
					06-16-98	1331	87.30	2,177.5	S	-	EMP
					07-14-98	1512	89.32	2,175.5	S	-	EMP
					08-06-98	1341	89.58	2,175.2	S	-	EMP
					09-14-98	1430	85.75	2,179.0	S	-	EMP
					10-27-98	--	85.30	2,179.5	T	-	NDWR
					10-27-98	1405	86.19	2,178.6	S	-	EMP
					11-19-98	1052	81.85	2,183.0	S	-	EMP
					12-17-98	1138	80.97	2,183.8	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-10	362525116274301	NA-9 Well	2,190.9	1.3	01-26-98	1634	11.32	2,179.6	S	-	EMP
					02-19-98	0900	11.31	2,179.6	S	-	EMP
					03-17-98	1309	11.28	2,179.6	S	-	EMP
					04-17-98	0734	11.35	2,179.6	S	-	EMP
					05-19-98	1119	11.84	2,179.1	S	-	EMP
					06-16-98	1305	11.76	2,179.1	S	-	EMP
					07-14-98	1540	11.80	2,179.1	S	-	EMP
					08-06-98	1405	11.95	2,179.0	S	-	EMP
					09-14-98	1509	12.09	2,178.8	S	-	EMP
					10-08-98	1327	12.18	2,178.7	S	-	EMP
					11-19-98	1030	12.20	2,178.7	S	-	EMP
					12-17-98	1105	12.26	2,178.6	S	-	EMP
AD-11	361954116181201	GS-3 Well	2,351.3	2.0	01-15-98	1435	221.59	2,129.7	S	-	EMP
					02-19-98	0730	221.42	2,129.9	S	-	EMP
					03-17-98	0725	220.88	2,130.4	S	-	EMP
					04-17-98	0625	220.64	2,130.7	S	-	EMP
					05-22-98	1020	219.85	2,131.4	S	-	EMP
					06-16-98	1108	219.14	2,132.2	S	-	EMP
					07-14-98	1212	218.94	2,132.4	S	-	EMP
					08-12-98	1135	218.68	2,132.6	S	-	EMP
					09-14-98	1130	218.38	2,132.9	S	-	EMP
					10-07-98	1250	218.34	2,133.0	S	-	EMP
					11-18-98	0648	218.42	2,132.9	S	-	EMP
					12-16-98	0647	218.58	2,132.7	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-12	362014116133901	GS-1 Well	2,430.3	2.0	01-15-98	1540	80.79	2,349.5	S	-	EMP
					02-19-98	0830	80.77	2,349.5	S	-	EMP
					03-17-98	0635	80.73	2,349.6	S	-	EMP
					04-16-98	1535	80.76	2,349.5	S	-	EMP
					05-19-98	0700	80.77	2,349.5	S	-	EMP
					06-16-98	1025	80.73	2,349.6	S	-	EMP
					07-14-98	1105	80.69	2,349.6	S	-	EMP
					08-12-98	1025	80.83	2,349.5	S	-	EMP
					09-15-98	0650	80.85	2,349.4	S	-	EMP
					10-07-98	0946	80.92	2,349.4	S	-	EMP
					11-19-98	0615	80.97	2,349.3	S	-	EMP
					12-17-98	0640	80.92	2,349.4	S	-	EMP
AD-13	361724116324201	S-1 Well	2,703.2	2.0	01-21-98	1318	380.33	2,322.9	S	-	EMP
					02-18-98	0735	380.48	2,322.7	S	-	EMP
					03-19-98	1247	379.06	2,324.1	S	-	EMP
					04-15-98	1427	379.10	2,324.1	S	-	EMP
					05-22-98	0732	379.97	2,323.2	S	-	EMP
					06-17-98	0702	380.31	2,322.9	S	-	EMP
					07-08-98	1147	379.78	2,323.4	S	-	EMP
					08-11-98	0820	374.53	2,328.7	S	-	EMP
					09-16-98	0735	373.49	2,329.7	S	-	EMP
					10-08-98	1046	373.10	2,330.1	S	-	EMP
					11-17-98	1325	373.39	2,329.8	S	-	EMP
					12-16-98	0820	373.95	2,329.2	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-14	361817116244701	Death Valley Jct Well	2,041.8	.7	01-15-98	1350	3.53	2,038.3	S	-	EMP
					02-27-98	1347	3.33	2,038.5	S	-	EMP
					03-19-98	1345	2.89	2,038.9	S	-	EMP
					04-15-98	1509	2.75	2,039.0	S	-	EMP
					05-22-98	0945	2.75	2,039.0	S	-	EMP
					06-16-98	1235	2.88	2,038.9	S	-	EMP
					07-14-98	1255	2.87	2,038.9	S	-	EMP
					08-11-98	0906	3.50	2,038.3	S	-	EMP
					09-14-98	1210	3.19	2,038.6	S	-	EMP
					10-07-98	1512	3.59	2,038.2	S	-	EMP
					11-17-98	1600	3.25	2,038.6	S	-	EMP
					12-16-98	0742	3.01	2,038.8	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AM-1	362858116195301	Rogers Spring Well	2,265.9	.1	01-14-98	1433	2.67	2,263.2	S	-	EMP
					01-26-98	0922	2.51	2,263.4	T	-	USFWS
					02-26-98	1305	2.33	2,263.6	T	-	USFWS
					03-17-98	1232	2.31	2,263.6	S	-	EMP
					03-19-98	1025	2.22	2,263.7	T	-	USFWS
					04-16-98	1012	2.41	2,263.5	S	-	EMP
					04-21-98	0853	2.29	2,263.6	T	-	USFWS
					05-19-98	1155	2.57	2,263.3	S	-	EMP
					05-28-98	1602	2.49	2,263.4	T	-	USFWS
					06-16-98	0803	2.78	2,263.1	S	-	EMP
					06-30-98	1010	2.83	2,263.1	T	-	USFWS
					07-14-98	0745	3.29	2,262.6	S	-	EMP
					07-21-98	0948	3.35	2,262.6	T	-	USFWS
					08-12-98	0822	3.76	2,262.1	S	-	EMP
					08-17-98	1355	3.67	2,262.2	T	-	USFWS
					09-15-98	0920	3.64	2,262.3	S	-	EMP
					09-25-98	0917	3.45	2,262.4	T	-	USFWS
					10-21-98	1357	3.12	2,262.8	T	-	USFWS
					10-27-98	0950	3.12	2,262.8	S	-	EMP
					11-19-98	0957	2.87	2,263.0	S	-	EMP
					11-23-98	0920	2.72	2,263.2	T	-	USFWS
					12-17-98	1000	2.68	2,263.2	S	-	EMP
					12-22-98	0925	2.61	2,263.3	T	-	USFWS

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AM-2	362755116190401	Five Springs Well	2,367.4	1.17	01-14-98	1315	.24	2,367.2	S	F	EMP
					02-27-98	1245	.23	2,367.2	S	F	EMP
					03-17-98	1030	.22	2,367.2	S	F	EMP
					04-16-98	1202	.22	2,367.2	S	F	EMP
					05-19-98	0814	.22	2,367.2	S	F	EMP
					06-16-98	0710	.23	2,367.2	S	F	EMP
					07-14-98	0620	.21	2,367.2	S	F	EMP
					08-12-98	0724	.22	2,367.2	S	F	EMP
					09-15-98	0812	.22	2,367.2	S	F	EMP
					10-27-98	0850	.22	2,367.2	S	F	EMP
					11-19-98	0847	.22	2,367.2	S	F	EMP
					12-17-98	0910	.23	2,367.2	S	F	EMP
AM-3	362555116205301	Garners Well	2,157.0	1.29	01-14-98	1520	18.86	2,138.1	S	-	EMP
					03-17-98	1144	17.81	2,139.2	S	-	EMP
					04-16-98	1320	17.54	2,139.5	S	-	EMP
					05-19-98	0941	17.43	2,139.6	S	-	EMP
					06-16-98	0819	17.53	2,139.5	S	-	EMP
					07-14-98	0823	17.88	2,139.1	S	-	EMP
					08-12-98	0847	18.43	2,138.6	S	-	EMP
					09-15-98	0936	19.00	2,138.0	S	-	EMP
					10-14-98	1215	19.40	2,137.6	S	-	EMP
					11-19-98	0825	19.40	2,137.6	S	-	EMP
					12-17-98	1025	19.08	2,137.9	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AM-4	362532116172700	Devils Hole	2,359.9	--	01-15-98	--	2.07	2,357.8	A	-	NPS
					02-15-98	--	2.03	2,357.9	A	-	NPS
					02-27-98	0857	2.08	2,357.8	N	-	EMP
					03-15-98	--	2.01	2,357.9	A	-	NPS
					04-15-98	--	2.04	2,357.9	A	-	NPS
					05-15-98	--	2.01	2,357.9	A	-	NPS
					05-27-98	1131	2.16	2,357.7	N	-	EMP
					06-15-98	--	2.01	2,357.9	A	-	NPS
					08-05-98	0915	2.16	2,357.7	N	-	EMP
					08-15-98	--	2.03	2,357.9	A	-	NPS
					09-15-98	--	2.01	2,357.9	A	-	NPS
					10-15-98	--	2.05	2,357.8	A	-	NPS
					11-15-98	--	2.07	2,357.8	A	-	NPS
					12-15-98	--	2.08	2,357.8	A	-	NPS

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AM-5	362529116171100	Devils Hole Well	2,404.1	.9	01-14-98	1215	48.21	2,355.9	S	-	EMP
					01-15-98	0832	48.13	2,356.0	S	-	USGS-NV
					01-26-98	1105	48.20	2,355.9	T	-	USFWS
					02-19-98	1344	48.16	2,355.9	S	-	USGS-NV
					02-26-98	1535	48.09	2,356.0	T	-	USFWS
					02-27-98	0839	48.14	2,356.0	S	-	EMP
					03-16-98	1101	48.08	2,356.0	S	-	EMP
					03-19-98	1010	48.12	2,356.0	S	-	USGS-NV
					03-19-98	1053	48.15	2,356.0	T	-	USFWS
					04-16-98	1042	48.16	2,355.9	S	-	EMP
					04-21-98	1055	48.16	2,355.9	T	-	USFWS
					04-30-98	1143	48.09	2,356.0	S	-	USGS-NV
					05-27-98	1157	48.18	2,355.9	S	-	EMP
					05-28-98	1120	48.16	2,355.9	T	-	USFWS
					05-29-98	1115	48.14	2,356.0	S	-	USGS-NV
					06-16-98	0834	48.02	2,356.1	S	-	EMP
					06-30-98	1053	48.13	2,356.0	T	-	USFWS
					07-14-98	0856	48.09	2,356.0	S	-	EMP
					07-21-98	1120	48.20	2,355.9	T	-	USFWS
					07-21-98	1354	48.16	2,355.9	S	-	USGS-NV
					08-05-98	0950	48.19	2,355.9	S	-	EMP
					08-17-98	1105	48.19	2,355.9	T	-	USFWS
					08-27-98	0809	48.14	2,356.0	S	-	USGS-NV
					09-15-98	0735	48.18	2,355.9	S	-	EMP
					09-25-98	0930	48.18	2,355.9	T	-	USFWS
					09-28-98	1300	48.13	2,356.0	S	-	USGS-NV
					10-13-98	1325	48.10	2,356.0	S	-	USGS-NV
					10-14-98	0933	48.15	2,356.0	S	-	EMP
					10-19-98	1322	48.17	2,355.9	S	-	USGS-NV
					10-21-98	1500	48.18	2,355.9	T	-	USFWS
					11-17-98	1203	48.10	2,356.0	S	-	EMP
					11-23-98	1440	48.19	2,355.9	T	-	USFWS
					12-17-98	0835	48.15	2,356.0	S	-	EMP
					12-22-98	1035	48.19	2,355.9	T	-	USFWS

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AM-6	362432116165701	Point of Rocks North Well	2,318.8	.0	01-14-98	1147	21.33	2,297.5	S	-	EMP
					01-26-98	1122	21.28	2,297.5	T	-	USFWS
					02-25-98	1547	21.17	2,297.6	S	-	EMP
					02-26-98	1225	21.12	2,297.7	T	-	USFWS
					03-17-98	0904	21.17	2,297.6	S	-	EMP
					03-19-98	0955	21.17	2,297.6	T	-	USFWS
					04-16-98	1419	21.32	2,297.5	S	-	EMP
					04-21-98	1205	21.24	2,297.6	T	-	USFWS
					05-19-98	1017	21.32	2,297.5	S	-	EMP
					05-28-98	1130	21.32	2,297.5	T	-	USFWS
					06-16-98	0910	21.31	2,297.5	S	-	EMP
					06-30-98	1125	21.35	2,297.4	T	-	USFWS
					07-14-98	0935	21.42	2,297.4	S	-	EMP
					07-21-98	1025	21.43	2,297.4	T	-	USFWS
					08-12-98	0927	21.53	2,297.3	S	-	EMP
					08-18-98	1052	21.50	2,297.3	T	-	USFWS
					09-15-98	1020	21.55	2,297.2	S	-	EMP
					09-25-98	1000	21.51	2,297.3	T	-	USFWS
					10-21-98	1510	21.45	2,297.4	T	-	USFWS
					10-27-98	1051	21.48	2,297.3	S	-	EMP
					11-19-98	0705	21.44	2,297.4	S	-	EMP
					11-23-98	1505	21.39	2,297.4	T	-	USFWS
					12-17-98	0720	21.48	2,297.3	S	-	EMP
					12-22-98	1105	21.46	2,297.3	T	-	USFWS

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AM-7	362417116163600	Point of Rocks South Well	2,333.5	.8	01-14-98	1102	7.74	2,325.8	S	-	EMP
					01-15-98	0913	7.69	2,325.8	S	-	USGS-NV
					01-26-98	1135	7.71	2,325.8	T	-	USFWS
					02-25-98	1546	7.57	2,325.9	S	-	EMP
					02-26-98	1245	7.60	2,325.9	T	-	USFWS
					03-17-98	0830	7.59	2,325.9	S	-	EMP
					03-18-98	1015	7.63	2,325.9	T	-	USFWS
					04-16-98	1446	7.68	2,325.8	S	-	EMP
					04-21-98	1200	7.65	2,325.8	T	-	USFWS
					05-19-98	1040	7.65	2,325.8	S	-	EMP
					05-28-98	1145	7.67	2,325.8	T	-	USFWS
					06-16-98	0945	7.60	2,325.9	S	-	EMP
					06-30-98	1135	7.72	2,325.8	T	-	USFWS
					07-14-98	1015	7.75	2,325.8	S	-	EMP
					07-21-98	1035	7.81	2,325.7	T	-	USFWS
					08-12-98	0955	7.81	2,325.7	S	-	EMP
					08-18-98	1040	7.84	2,325.7	T	-	USFWS
					09-15-98	1053	7.79	2,325.7	S	-	EMP
					09-25-98	1010	7.74	2,325.8	T	-	USFWS
					10-22-98	1520	7.66	2,325.8	T	-	USFWS
					10-27-98	1135	7.67	2,325.8	S	-	EMP
					11-19-98	0740	7.59	2,325.9	S	-	EMP
					11-24-98	1515	7.51	2,326.0	T	-	USFWS
					12-17-98	0802	7.49	2,326.0	S	-	EMP
					12-22-98	1055	7.52	2,326.0	T	-	USFWS

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1998--Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
DV-3	362230116392901	Travertine Point 1 Well	2,728.4	2.0	01-28-98	1522	601.02	2,127.4	V	-	EMP
					02-18-98	0920	601.10	2,127.3	V	-	EMP
					03-19-98	1132	601.16	2,127.2	V	-	EMP
					04-15-98	1341	601.07	2,127.3	V	-	EMP
					05-22-98	0853	601.01	2,127.4	V	-	EMP
					06-17-98	0810	601.04	2,127.4	V	-	EMP
					07-15-98	0705	601.00	2,127.4	V	-	EMP
					08-11-98	0717	601.04	2,127.4	V	-	EMP
					09-16-98	0640	601.01	2,127.4	V	-	EMP
					10-27-98	0728	601.10	2,127.3	V	-	EMP
					11-17-98	1042	601.01	2,127.4	V	-	EMP
					12-16-98	0912	601.26	2,127.1	V	-	EMP

Table 6. Daily average water levels in well JF-3 for calendar year 1998

[--, data not available]

Day	Water level, in feet below land surface											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	710.17	710.24	710.49	710.27	---	710.36	710.28	710.48	710.24	710.33	710.25	710.27
2	710.00	710.24	710.26	---	---	710.22	710.22	710.47	710.20	710.16	710.24	710.24
3	710.13	709.88	710.09	---	---	710.22	710.28	710.39	710.20	710.15	710.32	710.03
4	710.16	710.15	710.12	---	---	710.35	710.35	710.37	710.32	710.41	710.30	710.11
5	710.52	710.59	710.10	---	---	710.42	710.42	710.35	710.34	710.58	710.13	710.26
6	710.64	710.43	710.06	---	---	710.24	710.50	710.27	710.32	710.44	710.18	710.22
7	710.47	710.43	710.54	---	---	710.23	710.44	710.20	710.26	710.31	710.26	710.60
8	710.30	710.37	710.59	---	---	710.32	710.35	710.28	710.17	710.27	710.12	710.43
9	710.24	710.46	710.65	---	---	710.39	710.27	710.40	710.11	710.19	710.33	710.52
10	710.32	710.63	710.58	---	---	710.30	710.32	710.41	710.22	710.16	710.41	710.54
11	710.44	710.50	710.40	---	---	710.24	710.35	710.38	710.24	710.30	710.34	710.35
12	710.37	710.45	710.25	---	---	710.37	710.38	710.38	710.32	710.35	710.51	710.25
13	710.47	710.28	710.18	---	---	710.57	710.31	710.38	710.28	710.19	710.46	710.12
14	710.57	709.95	710.27	---	---	710.49	710.33	710.29	710.30	710.02	710.24	709.96
15	710.35	710.01	710.27	---	---	710.29	710.34	710.21	710.31	710.01	710.12	710.26
16	710.42	710.24	710.17	---	---	710.04	710.35	710.17	710.30	710.38	710.08	710.33
17	710.48	710.25	710.16	---	---	710.43	710.32	710.21	710.27	710.54	710.02	710.09
18	710.29	710.61	710.42	---	---	710.46	710.27	710.29	710.23	710.36	710.27	709.81
19	710.08	710.52	710.45	---	---	710.28	710.32	710.33	710.12	710.29	710.48	709.70
20	710.28	710.28	710.32	---	---	710.24	710.40	710.35	710.06	710.30	710.41	709.94
21	710.43	710.30	710.38	---	710.36	710.31	710.36	710.35	710.22	710.32	710.23	710.53
22	710.51	710.26	710.43	---	710.35	710.33	710.37	710.32	710.34	710.47	710.16	710.30
23	710.47	710.18	710.27	---	710.35	710.26	710.36	710.19	710.34	710.42	710.15	710.38
24	710.41	710.06	710.07	---	710.36	710.27	710.38	710.18	710.26	710.15	710.21	710.50
25	710.49	710.41	710.04	---	710.18	710.25	710.42	710.24	710.19	710.06	710.33	710.40
26	710.41	710.43	710.18	---	710.18	710.35	710.41	710.29	710.16	710.15	710.19	710.16
27	710.31	710.53	710.27	---	710.45	710.36	710.34	710.42	710.37	710.26	710.02	710.17
28	710.30	710.63	709.96	---	710.43	710.34	710.27	710.42	710.32	710.27	709.92	710.22
29	710.18	---	710.27	---	710.40	710.35	710.22	710.38	710.21	710.05	710.21	710.14
30	710.35	---	710.51	---	710.41	710.33	710.21	710.31	710.30	710.17	710.34	710.01
31	710.25	---	710.37	---	710.45	---	710.34	710.31	---	710.39	---	709.93
MEAN	710.35	710.33	710.29	--	710.36	710.32	710.34	710.32	710.25	710.27	710.24	710.22
MAX	710.64	710.63	710.65	--	710.45	710.57	710.50	710.48	710.37	710.58	710.51	710.60
MIN	710.00	709.88	709.96	--	710.18	710.04	710.21	710.17	710.06	710.01	709.92	709.70

(1998 annual summary Mean 710.30 Maximum 710.65 Minimum 709.70)

Table 7. Daily average water levels in well AD-6 for calendar year 1998

[--, data not available]

Day	Water level, in feet below land surface											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	41.62	41.65	41.72	41.61	41.58	41.62	41.59	41.70	41.61	41.68	41.66	41.69
2	41.55	41.65	41.63	41.76	41.59	41.57	41.57	41.68	41.60	41.60	41.66	41.69
3	41.62	41.48	41.57	41.66	41.62	41.59	41.59	41.65	41.60	41.61	41.70	41.60
4	41.62	41.63	41.61	41.62	41.60	41.65	41.62	41.64	41.66	41.72	41.68	41.65
5	41.78	41.79	41.59	41.62	41.60	41.66	41.65	41.64	41.66	41.78	41.61	41.72
6	41.80	41.69	41.57	41.61	41.65	41.57	41.68	41.60	41.64	41.71	41.65	41.70
7	41.73	41.71	41.78	41.68	41.63	41.59	41.65	41.58	41.62	41.67	41.68	41.87
8	41.66	41.68	41.76	41.73	41.60	41.63	41.62	41.63	41.58	41.66	41.62	41.78
9	41.65	41.72	41.78	41.68	41.58	41.65	41.59	41.67	41.57	41.63	41.73	41.83
10	41.68	41.80	41.74	41.58	41.63	41.60	41.62	41.67	41.62	41.63	41.75	41.84
11	41.72	41.74	41.67	41.48	41.57	41.59	41.63	41.66	41.62	41.69	41.71	41.77
12	41.68	41.73	41.63	41.62	41.54	41.64	41.64	41.66	41.65	41.70	41.79	41.74
13	41.73	41.66	41.61	41.63	41.64	41.73	41.61	41.66	41.63	41.62	41.77	41.68
14	41.77	41.53	41.66	41.62	41.71	41.67	41.62	41.63	41.64	41.56	41.68	41.62
15	41.67	41.59	41.65	41.65	41.69	41.59	41.63	41.61	41.65	41.58	41.64	41.75
16	41.72	41.67	41.60	41.73	41.59	41.50	41.62	41.59	41.65	41.73	41.63	41.75
17	41.74	41.65	41.60	41.73	41.66	41.70	41.61	41.61	41.63	41.77	41.60	41.64
18	41.66	41.81	41.72	41.69	41.64	41.67	41.59	41.65	41.62	41.68	---	41.55
19	41.58	41.74	41.71	41.64	41.60	41.59	41.62	41.66	41.58	41.66	41.79	41.52
20	41.68	41.65	41.64	41.65	41.60	41.58	41.66	41.66	41.57	41.67	41.75	41.64
21	41.73	41.67	41.68	41.64	41.63	41.62	41.63	41.65	41.64	41.68	41.68	41.87
22	41.76	41.65	41.69	41.58	41.62	41.62	41.65	41.64	41.68	41.75	41.67	41.74
23	41.73	41.61	41.62	41.54	41.62	41.59	41.64	41.58	41.67	41.72	41.66	41.78
24	41.71	41.56	41.54	41.58	41.62	41.60	41.65	41.58	41.64	41.62	41.68	41.84
25	41.75	41.72	41.54	41.63	41.55	41.59	41.67	41.61	41.62	41.60	41.74	41.79
26	41.70	41.71	41.61	41.70	41.57	41.63	41.66	41.62	41.61	41.65	41.67	41.69
27	41.67	41.74	41.62	41.67	41.68	41.62	41.62	41.67	41.71	41.69	41.61	41.71
28	41.68	41.78	41.49	41.63	41.65	41.61	41.60	41.66	41.66	41.68	41.58	41.73
29	41.62	---	41.65	41.63	41.65	41.62	41.59	41.64	41.62	41.58	41.71	41.68
30	41.71	---	41.73	41.60	41.64	41.61	41.59	41.62	41.67	41.65	41.74	41.62
31	41.65	---	41.64	---	41.66	---	41.65	41.64	---	41.73	---	41.59
MEAN	41.69	41.68	41.65	41.64	41.62	41.62	41.62	41.64	41.63	41.67	---	41.71
MAX	41.80	41.81	41.78	41.76	41.71	41.73	41.68	41.70	41.71	41.78	---	41.87
MIN	41.55	41.48	41.49	41.48	41.54	41.50	41.57	41.58	41.57	41.56	---	41.52

(1998 annual summary Mean 41.65 Maximum 41.87 Minimum 41.48)

Table 8. Ground-water-discharge data at monitoring sites in Yucca Mountain region for calendar year 1998

Site number: Sites are grouped by hydrographic area and, within each area, are listed in general north-to-south, then west-to-east order. See text section "Site Number" for further discussion.

U.S. Geological Survey site identification: Unique identification number for site as stored in files and data bases of U.S. Geological Survey (USGS).

Discharge: Reported to two significant figures.

Method: Method used to measure discharge. C, current meter; F, flume; V, volumetric; Z, discharge represents monthly mean discharge on basis of continually recorded stage (see text section "Ground-Water Discharge Data" for further discussion).

Data source: EMP, Environmental-Monitoring Program (USGS); NPS, National Park Service; USFWS, U.S. Fish and Wildlife Service.

Site number (fig.1)	U.S. Geological Survey site identification	Site name	Discharge measurement				
			Date	Time	Discharge (gallons per minute)	Method	Data source
AM-1a	362924116203001	Fairbanks Spring	01-26-1998	0950	1,800	F	USFWS
			02-19-1998	1220	1,800	F	USFWS
			02-25-1998	1255	1,700	C	EMP
			03-20-1998	0945	1,800	F	USFWS
			04-27-1998	1030	1,800	F	USFWS
			05-22-1998	1515	1,800	F	USFWS
			05-27-1998	1259	1,700	C	EMP
			06-25-1998	1030	1,700	F	USFWS
			07-20-1998	1000	1,700	F	USFWS
			08-06-1998	0940	1,700	C	EMP
			08-17-1998	1420	1,700	F	USFWS
			09-24-1998	0940	1,700	F	USFWS
			10-21-1998	1420	1,700	F	USFWS
			11-18-1998	1222	1,700	C	EMP
			11-23-1998	0945	1,800	F	USFWS
			12-24-1998	0945	1,800	F	USFWS
AM-2	362755116190401	Five Springs Well	01-14-1998	1337	40	V	EMP
			02-27-1998	1226	43	V	EMP
			03-17-1998	1046	42	V	EMP
			04-16-1998	1217	38	V	EMP
			05-19-1998	0827	40	V	EMP
			06-16-1998	0724	42	V	EMP
			07-14-1998	0633	40	V	EMP
			08-12-1998	0737	41	V	EMP
			09-15-1998	0826	40	V	EMP
			10-27-1998	0904	42	V	EMP
			11-19-1998	0902	41	V	EMP
			12-17-1998	0927	40	V	EMP
AM-5a	362502116192301	Crystal Pool	01-28-1998	1140	3,200	C	USFWS
			02-25-1998	1425	3,200	C	EMP
			02-27-1998	0915	3,200	C	USFWS
			03-17-1998	1430	3,400	C	USFWS
			05-26-1998	1106	3,100	C	EMP
			06-30-1998	1200	2,900	C	USFWS
			07-21-1998	1300	2,800	C	USFWS
			08-06-1998	0738	2,900	C	EMP
			08-18-1998	1200	2,700	C	USFWS
			09-25-1998	1500	2,700	C	USFWS
			10-22-1998	0800	2,500	C	USFWS
			11-18-1998	1029	2,900	C	EMP
			11-24-1998	1130	2,600	C	USFWS
			12-22-1998	1615	3,000	C	USFWS

Table 8. Ground-water-discharge data at monitoring sites in Yucca mountain region for calendar year 1998--Continued

Site number (fig.1)	U.S. Geological Survey site identification	Site name	Discharge measurement				
			Date	Time	Discharge (gallons per minute)	Method	Data source
AM-8	362230116162001	Big Spring	01-27-1998	1330	960	C	USFWS
			02-26-1998	1500	1,000	C	USFWS
			03-18-1998	0910	870	C	USFWS
			03-20-1998	1159	1,000	C	EMP
			05-26-1998	1429	890	C	EMP
			06-30-1998	1325	930	C	USFWS
			07-21-1998	0915	930	C	USFWS
			08-06-1998	1034	900	C	EMP
			08-18-1998	0800	960	C	USFWS
			09-25-1998	1300	970	C	USFWS
			10-22-1998	1310	840	C	USFWS
			11-18-1998	0835	1,000	C	EMP
			11-24-1998	0835	1,000	C	USFWS
			12-22-1998	1410	1,100	C	USFWS
DV-1	362728116501101	Texas Spring	01-15-1998	--	200	Z	NPS
			02-15-1998	--	200	Z	NPS
			03-15-1998	--	200	Z	NPS
			03-23-1998	1248	200	C	EMP
			04-15-1998	--	200	Z	NPS
			05-15-1998	--	200	Z	NPS
			05-27-1998	0820	200	C	EMP
			06-15-1998	---	200	Z	NPS
			07-15-1998	--	200	Z	NPS
			08-05-1998	0628	190	C	EMP
			08-15-1998	--	190	Z	NPS
			09-15-1998	--	190	Z	NPS
			10-15-1998	--	190	Z	NPS
			11-15-1998	--	200	Z	NPS
			11-17-1998	0836	200	C	EMP
			12-15-1998	--	200	Z	NPS
DV-2	362252116425301	Navel Spring	02-27-1998	1105	1.0	V	EMP
			05-27-1998	0945	.90	V	EMP
			08-05-1998	0750	.90	V	EMP
			11-17-1998	0945	.90	V	EMP

Table 9. Estimated annual ground-water withdrawals from wells in Yucca Mountain region for calendar year 1998

Ground-water subbasin (fig. 1)	Hydrographic area (fig. 1	Ground-water withdrawal [1]	
		Millions of gallons	Acre-feet
Alkali Flat-Furnace Creek Ranch	Amargosa Desert [2]	4,989	15,310
Do.	Crater Flat[3]	67.4	207
Do.	Jackass Flats [3]	48.8	150
Ash Meadows	Amargosa Desert[2] (excluding Ash Meadows area)	19	58
Do.	Amargosa Desert[2] (Ash Meadows area)	3	8
Do.	Mercury Valley[3]	1.0	3

[1] See text section "Ground-Water Withdrawal Data" for discussion of data sources.

[2] Data recompiled from ground-water pumpage inventory for entire Amargosa Desert, listed to nearest acre-foot. Domestic use within each part of the Amargosa Desert is based on location and number of wells drilled for domestic purposes (as stored in files maintained by Nevada Divison of Water Resources). Conversion to millions of gallons is rounded to nearest 1 million gallons.

[3] Data reported or recompiled from flowmeter readings and listed to nearest 0.1 million gallons. Conversions to acre-feet are rounded to nearest acre-foot.

Table 10. Minimum, maximum, and median water-level altitudes, and average deviation of measurements, at wells in Jackass Flats for selected baseline periods and for calendar years 1992 through 1998. Excludes water-level altitudes that may reflect short-term conditions at a site.

Calendar years: Years for which measurements were used to calculate summary statistics. Italics indicate selected baseline period.

Number: Number of water-level measurements for year(s) specified. For JF-2 (1985-93), JF-2a (1985-97), and JF-3, value represents number of daily average water levels.

Water level: Based on periodic water-level measurements made during site visits for JF-1, JF-2 (after 1993), JF-2a (after 1997), J-13, J-11, and J-12. Based on daily average water levels collected from continual data recorders for JF-2 (1985-93), JF-2a (1985-97), and JF-3.

Minimum: Minimum water-level altitude or minimum daily average water-level altitude for year(s) specified.

Maximum: Maximum water-level altitude or maximum daily average water-level altitude for year(s) specified.

Median: Statistically representative water-level altitude calculated from periodic measurements or daily average water levels for year(s) specified.

Average deviation: Calculated dispersion of measurements about median water-level altitude. Average deviation is equal to sum of absolute differences between measured water levels and median, divided by number of measurements.

Change in median: Differences between median water level for calendar years 1992, 1993, 1994, 1995, 1996, 1997, and 1998 compared with baseline period. Minus sign indicates that median water-level altitude was lower for the specified year than for the baseline period.

[Abbreviations and symbols: N/A, not applicable (data field is not related to referenced data set)]

Site number (fig. 1)	Calendar year(s)	Number	Water level (feet above sea level)			Average deviation (feet)	Change in median (feet)
			Minimum	Maximum	Median		
JF-1	*1985-91*	86	2,391.7	2,393.1	2,392.5	0.2	N/A
JF-2	*1985-91*	1,777	2,389.6	2,393.4	2,392.1	.3	N/A
JF-2a	*1985-91*	1,876	2,466.7	2,469.5	2,468.6	.4	N/A
J-13	*1989-91*	32	2,389.7	2,390.7	2,390.0	.2	N/A
J-11	*1990-91*	25	2,401.9	2,402.9	2,402.2	.1	N/A
J-12	*1990-91*	22	2,388.1	2,388.5	2,388.3	.1	N/A
JF-3	*1992-93*	582	2,387.7	2,388.8	2,388.3	.1	N/A
JF-1	1998	22	2,392.3	2,392.8	2,392.5	.1	0
JF-2	1998	21	2,391.8	2,392.6	2,392.1	.1	0
JF-2a	1998	20	2,469.8	2,470.4	2,470.0	.1	1.4
J-13	1998	20	2,389.4	2,390.2	2,389.8	.1	-.2
J-11	1998	20	2,402.2	2,402.9	2,402.6	.2	.4
J-12	1998	17	2,387.9	2,388.3	2,388.0	.1	-.3
JF-3	1998	316	2,387.6	2,388.6	2,388.0	.1	-.3
JF-1	1997	10	2,392.1	2,392.6	2,392.4	.1	-0.1
JF-2	1997	11	2,391.8	2,392.4	2,392.0	.1	-.1
JF-2a	1997	267	2,468.8	2,470.0	2,469.5	.1	.9
J-13	1997	11	2,389.5	2,389.9	2,389.6	.1	-.4
J-11	1997	10	2,402.2	2,402.8	2,402.6	.2	.4
J-12	1997	16	2,387.7	2,388.4	2,388.0	.1	-.3
JF-3	1997	345	2,387.4	2,388.8	2,388.0	.1	-.3
JF-1	1996	8	2,392.0	2,392.6	2,392.3	0.2	-0.2
JF-2	1996	7	2,391.6	2,392.3	2,392.1	.2	.0
JF-2a	1996	214	2,468.6	2,469.6	2,469.3	.1	.7
J-13	1996	8	2,389.2	2,389.9	2,389.6	.1	-.4
J-11	1996	8	2,402.2	2,402.6	2,402.4	.1	.2
J-12	1996	18	2,387.5	2,388.5	2,388.0	.1	-.3
JF-3	1996	359	2,387.5	2,388.5	2,388.0	.1	-.3

Table 10. Minimum, maximum, and median water-level altitudes, and average deviation of measurements, at wells in Jackass Flats for selected baseline periods and for calendar years 1992 through 1998—Continued

Site number (fig. 1)	Calendar year(s)	Number	Water level (feet above sea level)			Average deviation (feet)	Change in median (feet)
			Minimum	Maximum	Median		
JF-1	1995	7	2,392.3	2,392.8	2,392.5	.2	.0
JF-2	1995	9	2,392.2	2,392.5	2,392.4	.1	.3
JF-2a	1995	357	2,468.7	2,469.3	2,469.1	.1	.5
J-13	1995	11	2,389.6	2,390.4	2,389.8	.1	-.2
J-11	1995	11	2,402.2	2,402.5	2,402.4	.1	.2
J-12	1995	16	2,388.0	2,388.3	2,388.2	.1	-.1
JF-3	1995	347	2,387.7	2,388.4	2,388.1	.1	-.2
JF-1	1994	12	2,392.1	2,392.6	2,392.3	.1	-.2
JF-2	1994	9	2,392.0	2,392.6	2,392.2	.1	.1
JF-2a	1994	356	2,468.4	2,469.4	2,469.0	.1	.4
J-13	1994	23	2,389.4	2,390.0	2,389.7	.1	-.3
J-11	1994	12	2,402.0	2,402.5	2,402.3	.1	.1
J-12	1994	24	2,387.8	2,389.1	2,388.2	.2	-.1
JF-3	1994	284	2,387.6	2,388.6	2,388.1	.1	-.2
JF-1	1993	8	2,391.9	2,392.7	2,392.5	.2	0
JF-2	1993	362	2,391.7	2,392.8	2,392.1	.2	0
JF-2a	1993	365	2,468.4	2,469.2	2,468.8	.1	.2
J-13	1993	16	2,389.7	2,390.7	2,389.9	.1	-.1
J-11	1993	8	2,401.9	2,402.7	2,402.2	.2	0
J-12	1993	19	2,387.9	2,389.0	2,388.3	.1	0
JF-1	1992	12	2,392.3	2,392.6	2,392.4	.1	-.1
JF-2	1992	357	2,391.8	2,392.6	2,392.2	.1	.1
JF-2a	1992	342	2,466.9	2,469.2	2,468.6	.5	0
J-13	1992	21	2,389.6	2,390.4	2,389.9	.1	-.1
J-11	1992	12	2,402.0	2,402.6	2,402.2	.1	0
J-12	1992	17	2,388.2	2,388.6	2,388.3	.1	0